THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXXII. No. 2085.] LONDON, APRIL 28, 1903. [55TH YEAR. PRICE 6d.

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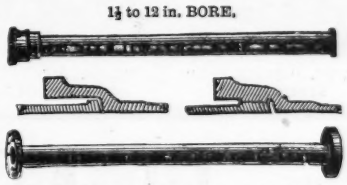

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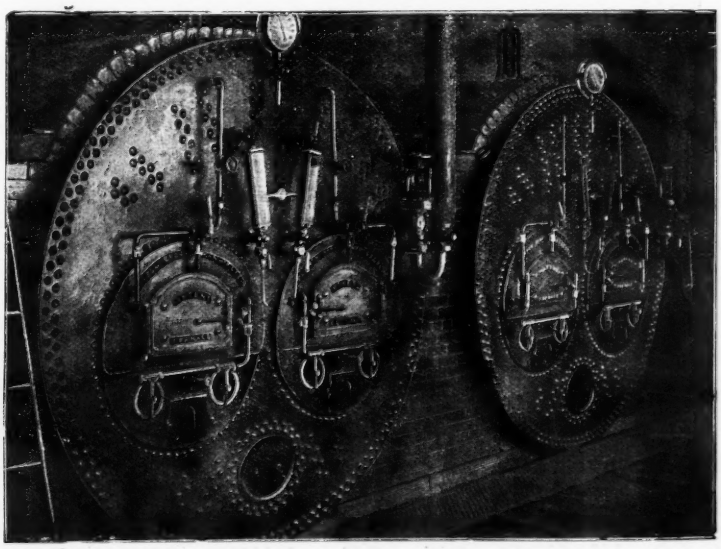

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Fig. 705. "SINGLE RAM" STEAM-PUMP.

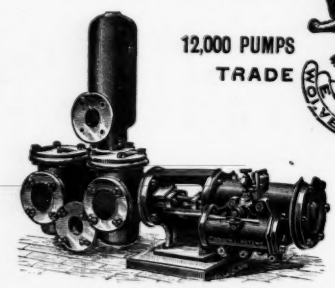

Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

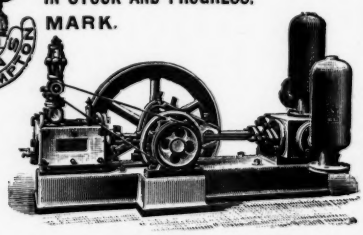

Fig. 685. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

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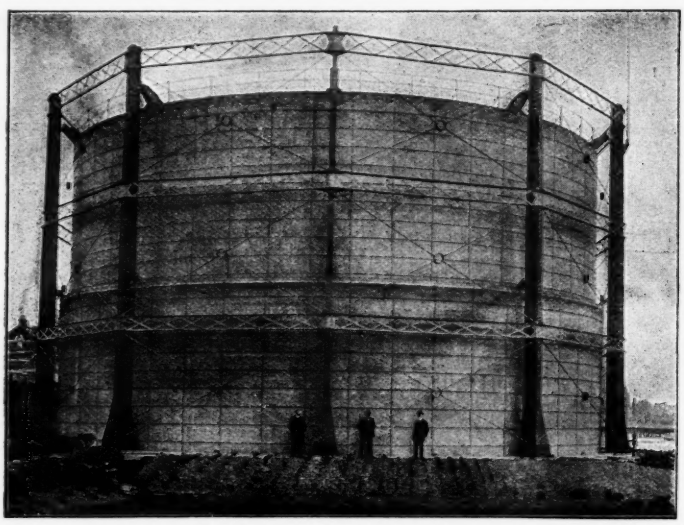

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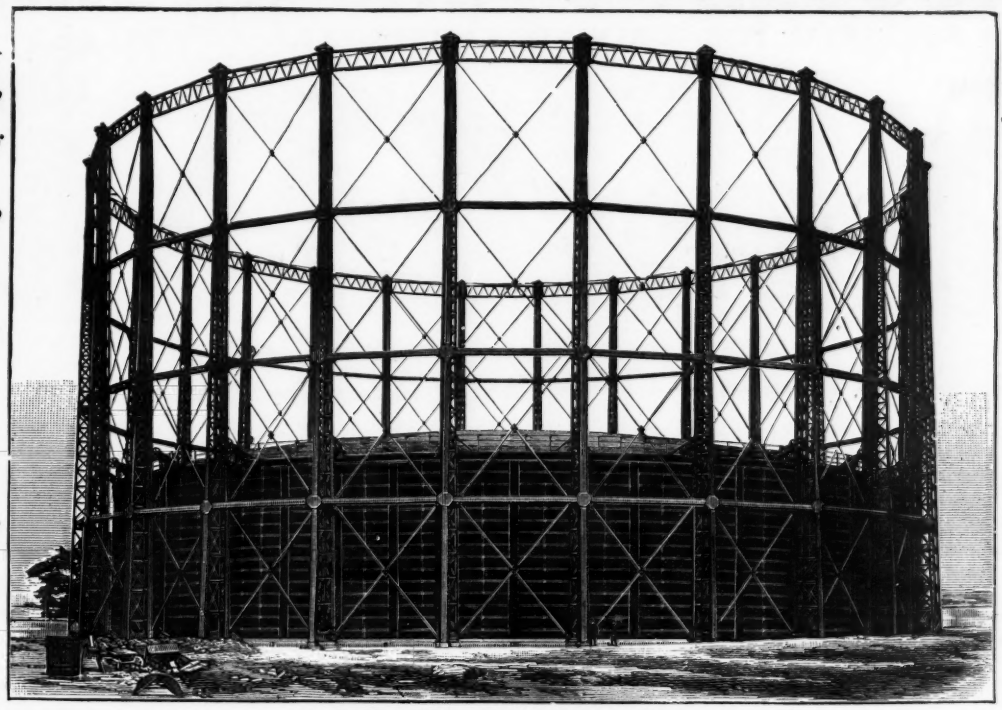

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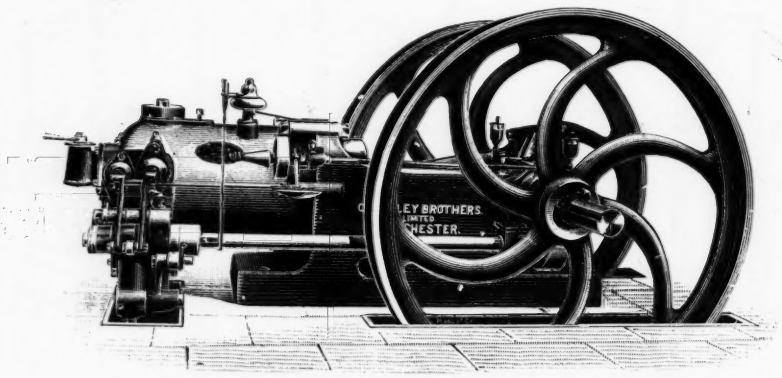

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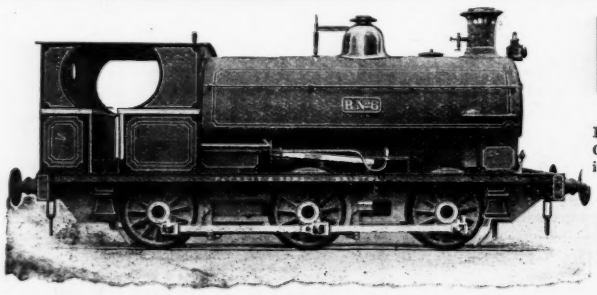

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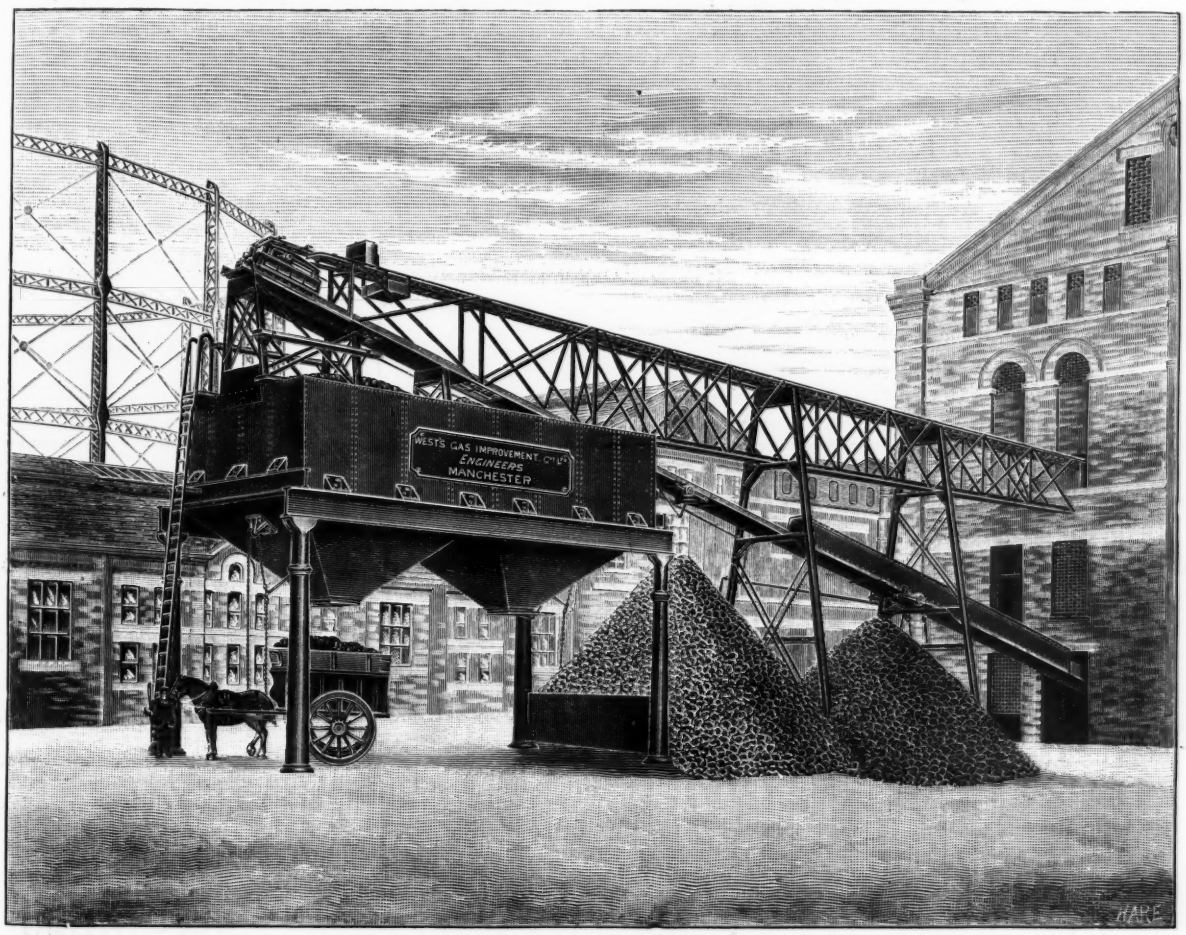

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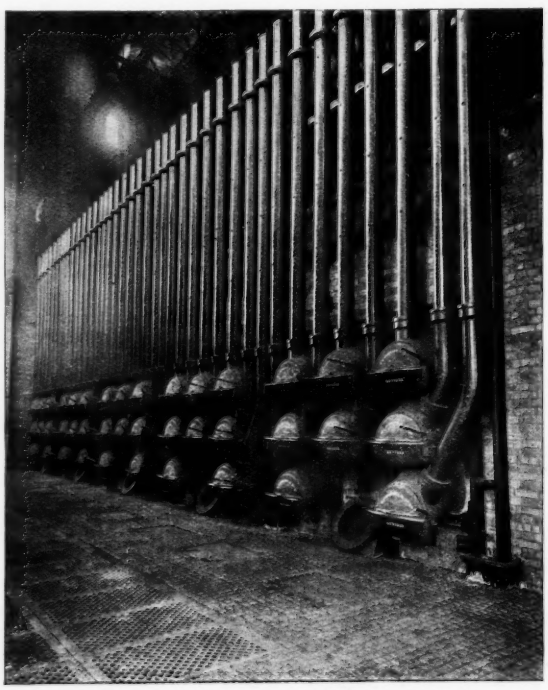

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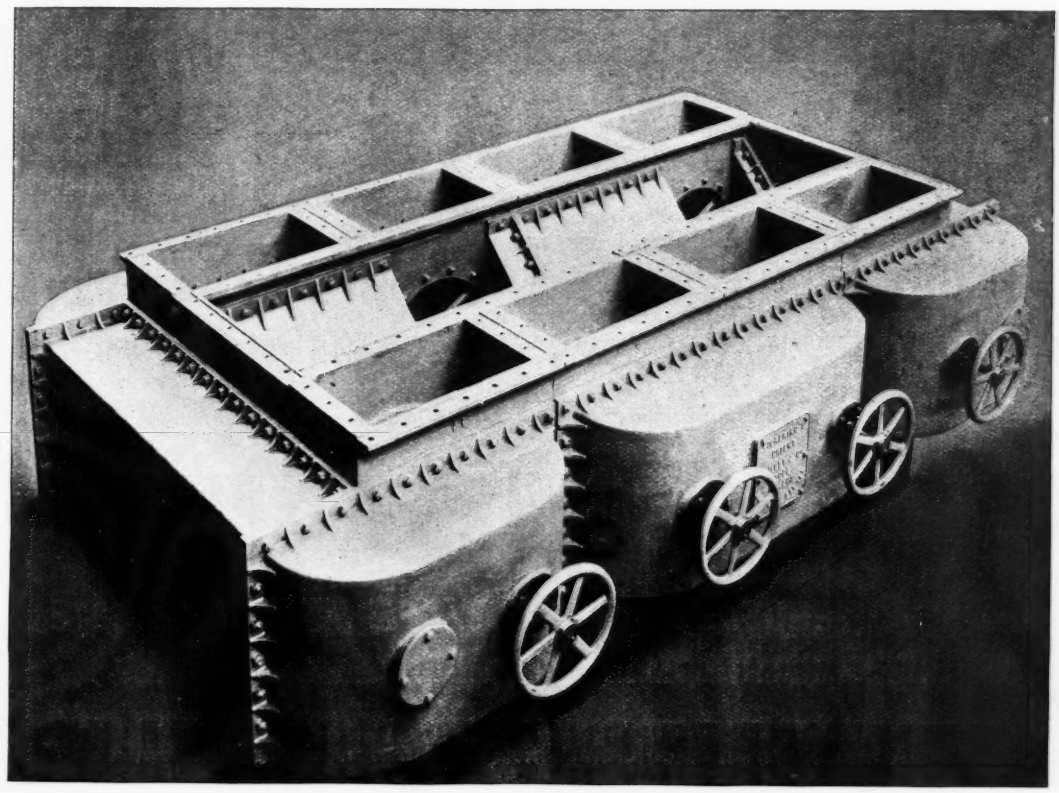

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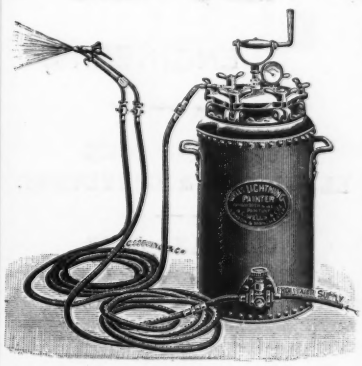

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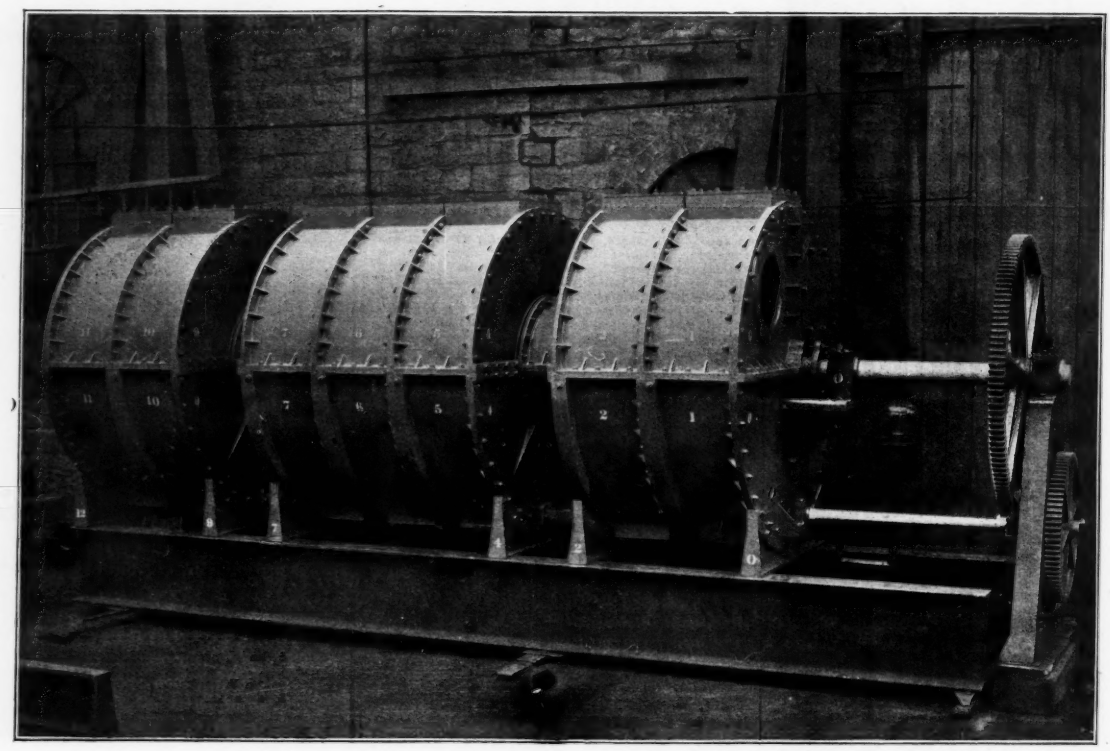

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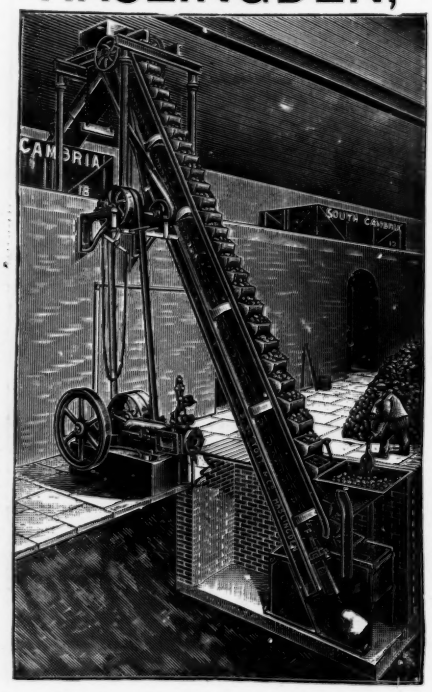

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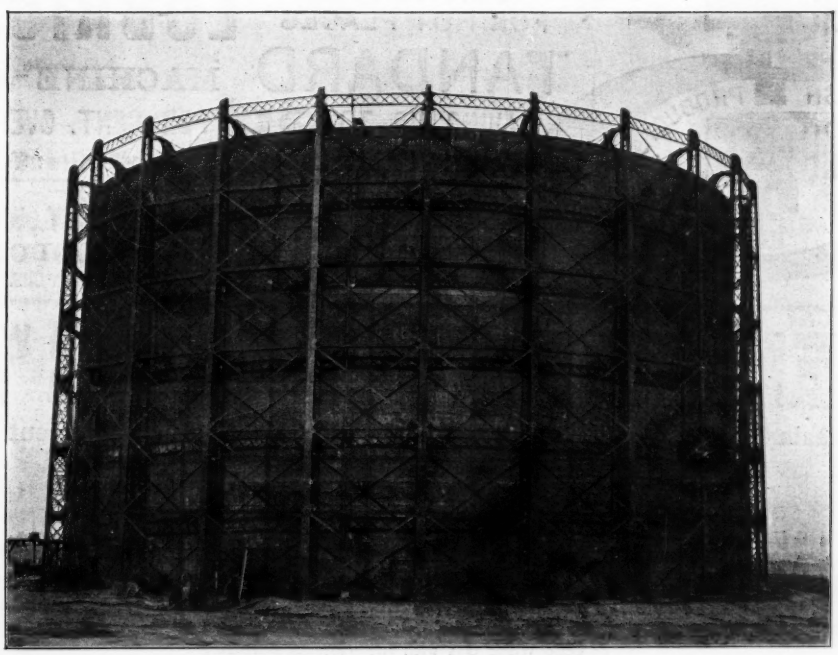

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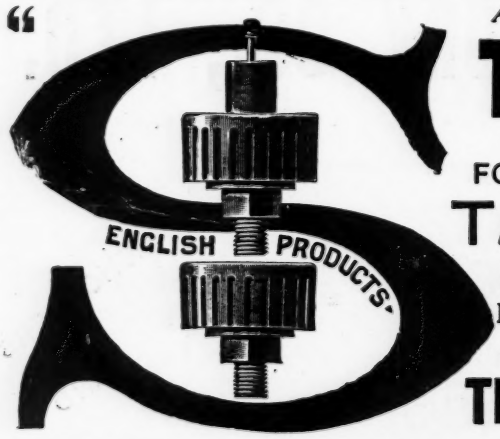

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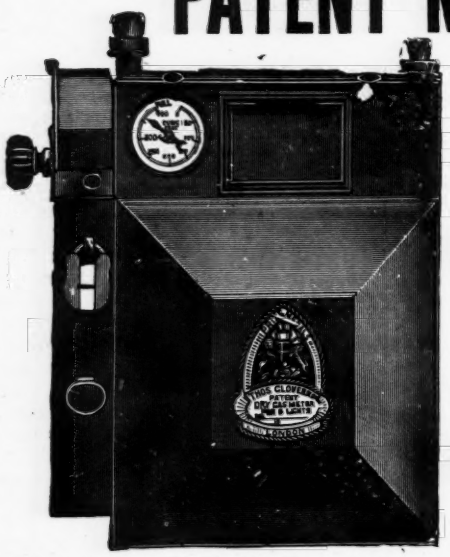

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EDITORIAL NOTES.

The Report of the Mosely Commission.

A GOOD deal of wild discussion has arisen over the report of the Mosely Commission on American trade methods, which was mentioned in last Tuesday's "JOURNAL." The occasion seems a favourable one for distinguishing some salient points of the philosophy of such inquiries, attention to which may help towards the interpretation of their results. In the first place, it is of supreme importance that the profound truth of the observation of Goethe—"Men perceive what they already "know"—should be borne in mind. It is very commonly neglected in the composition of Royal Commissions and travelling deputations of Municipal Corporations. Another expression of the same truth is the saying that "whosoever "goes to seek the wealth of the Indies, must take it with "him." What these apophthegms mean is, that it is not of the slightest use to send anybody to look into a matter which preconceived ideas, or personal incapacity, prevent him from seeing in the right light. A thoroughly prejudiced Trade Unionist may go all round the world, and only see what confirms and strengthens his prejudice. An ordinary fluent newspaper reporter will deal with everything but the one thing that really matters, in whatever he may attempt to describe without adequate previous knowledge of the subject. Really, neither technical knowledge nor freedom from prejudice—in fact, no other special preparation save personal ability, honesty of purpose, and the power of forming a just conclusion from the evidence—is essential in qualifying a man to be a fit member of a Commission to inquire into methods of labour, or any other matter. If the bulk of the members of the Mosely Commission do not, by the tenour of their reports, impress one with much respect for their judicial capacity, the usual run of newspaper comments on their statements merely darken counsel to the point of obscuration of whatever instruction they contain.

The most obvious piece of information collected by the Mosely Commission, and the one which is likely to have the greatest weight with those who get hold of it, is that for the working man there is no redress, in simple emigration to the New World, for anything he may dislike in the Old. It comes out clearly enough, from all these several witnesses, that the United States is a hard foster-mother for the poor man. The superficial equality of the community, if not exclusively "conversational," as some remark, is certainly due to the common subservience to the Almighty Dollar. Many of the newspapers lay great stress upon the alleged friendliness of workmen in America towards machines for the saving of labour. The truth is that they cannot help themselves. This matter of the meritoriousness of doing many things by mechanism instead of by hand is greatly misunderstood. The truth of it is no more, than that those who have work to be done for them universally desire that it should be performed by the cheapest and most trustworthy agency. Some work can be done better and more cheaply by machinery than by hand; and in such cases the machine does it in the long run. Other work can be done indifferently by hand or machine, and the choice of the means then becomes a question of expediency. Lastly, there is work which is best done by hand, and not so well, or not at all, by machinery. It is absurd to pretend that herein lies any material suitable for use in argument to prove that one way of doing work is more "advanced" than another. Hair-brushing by machinery was once the fashion in "advanced" barber-shops; but the fashion has passed away, because it was not a real improvement in any sense. A vast amount and a great variety of so-called labour-saving machinery belongs to the same category as the hair-brushing engine. Hand-work, where it can be obtained on reasonable terms, and is suitable for its purpose, will take a lot of beating by machine. On the other hand, where hand-work is scarce or bad as well as dear, as it appears to be in most "young" countries, it becomes compulsory to put up with machine performance of the nearest equivalent.

A common error into which the "St. James's Gazette" falls, in discussing the Mosely reports, is the belief that Americans are a peculiarly inventive race; that most inventions of a mechanical kind are produced by workmen "prompted by the desire to lighten their own toil;" and that American employers of such genius are more honest in their dealings with it than Englishmen. This is another instance of failure (partly due to ignorance of the facts) to look at the subject in the right light. The pleasant idea of the workman being the originator of most of the labour-saving machinery in use, is not borne out by experience. It is not the gas stoker who invents the stoking-machine, nor the agricultural labourer who makes the "harvester." There is some little truth in the complaint that the employer everywhere, not only in England, is not always more directly accessible by the workman with an idea; nor does the inventor invariably receive honest treatment. But it would be hard to prove that honesty in any walk of life is rarer in this country than in another.

The Budget.

THE Chancellor of the Exchequer has produced his Budget; and, as we write, income-tax payers are smiling over a reduction of their burden to 11d. in the pound—which is a penny better than the most sanguine of the order had hoped for. The effect of this relief upon the enterprise, industry, and trade of the nation will be great and beneficent. The diversion of the 8½ millions of money, represented by the relinquished 4d. in the pound, from the barren gulf of taxation to the fertile ground of commerce, must be good for trade; and the indirect relief will be equally beneficial. The Chancellor of the Exchequer, in putting the tax down to a penny below the even shilling in the pound, has been well inspired. He has herein displayed practical wisdom of no mean order. The attraction of "even money" is notorious; and the prices of many commodities in every-day use are regulated, within limits, rather by the currency than by their intrinsic value. If Mr. Ritchie had fixed the income-tax at a shilling, the temptation in future years would have been to let it remain at this level amount. A tax of 11d. in the pound, on the contrary, challenges justification every time the figure is mentioned. It is unnecessary to argue the case of the income-tax payers for the earliest and largest possible remission of the amount of their payments for the maintenance of the national cause. They have paid without any whining while they felt that their country needed their support; and they will pay again whenever a similar need arises. Meanwhile, there is everything to be said in favour of making the income-tax as light as possible in time of peace. It is, to say the least of it, an excellent way of preparing for war, and a way that cannot give offence to any other nation.

The only other remission of taxation given by the Chancellor of the Exchequer was the dropping of the much-debated import duty of a shilling a quarter on corn, put on as a last resource by the preceding Chancellor. It is satisfactory to reflect that the export duty on coal, and the increased duties on the articles of consumption which are still made to bear indirect taxation for revenue purposes, have been retained for the time being. But for the duties on these consumables, the great and mighty British Workman, who at parliamentary elections is implored to rally in his thousands for the support or the destruction of Governments, would escape almost scot-free from the irksome but respectable business of paying for his political fancy. With regard to the corn duty, however, the questions of justice and expediency are sadly mixed. The difference between what is lawful and what is expedient, is nowhere more keenly felt than in the matter of taxation. When money is much wanted because the existence of the State is at stake, anything and everything may be laid under contribution. In the absence of such emergency, the point of mere expediency in the raising of revenue assumes overwhelming importance. Our own record in respect to the proceedings of the late Chancellor of the Exchequer is quite clear. We expressed approval of his last Budgets, in

defiance of *doctrinaire* objections, and would do so again in similar circumstances. At the same time, we held that the abstract fairness, to say nothing of the necessity, of a tax does not depend on its incidence. It was, as Lord Goschen showed, difficult to say who pays such an impost as the corn tax at any particular time; although in the long run the consumer would inevitably have to bear it. In ways that cannot be gone into here, the reimposed corn tax, while fulfilling its immediate purpose, has commended itself to the Administration that adopted it as a convenient tax to take off again. So be it. It will not be missed; and, if ever wanted, it or an equivalent can always be put on again.

Water Gas and Other Topics at the Eastern Counties Meeting.

THE proceedings at the meeting of the Eastern Counties Gas Managers' Association last Wednesday must be regarded with mixed feelings of satisfaction and dissatisfaction. The cordiality of the reception the members received from the representatives of the gas industry in the ancient town of King's Lynn, the completeness of the arrangements made by the energetic Engineer of the Gas Company (Mr. E. G. Smithard), and the fulness of the programme, left nothing to be desired; but the discussion of the chief item in the programme—the paper by Mr. E. J. Brockway on "Blue Water Gas, and Its Enrichment by the Peebles Oil-Gas Process"—was inconclusive in the extreme. The paper itself was good so far as it went; but it did not go far enough. That was not the fault of the author. The fault is found in the brevity of experience with the dual plant at Cleethorpes, and the inchoate records of working under the several conditions for which it was expressly adopted. In our view a mistake was made in inducing Mr. Brockway, and by that gentleman in succumbing to the inducement, at this incipient stage of his working with the plant, to submit it and his brief experience and records to a meeting of gas engineers until the whole range of the possibilities of the plant—its adaptability to various methods of working—had been completely tested by daily operation over a lengthened period. Moreover, no one, other than Mr. J. Carter, of Lincoln, who had had any daily practical working experience of water-gas manufacture in any form took part in the discussion. It would have been far better, and more satisfying to the gas profession at large, for the paper, but in a more complete form, and the (in the particular combination) innovation in gas manufacture, to have been presented at a meeting comprehending engineers of experience in the varied methods of utilizing water gas. There would then have been a discussion more in measure in quality with the importance of the subject.

Let it not, however, be supposed that in saying this it is a nicely concealed admission that the criticism of Mr. Carter, acute as it was, disposes of the Cleethorpes dual plant as being inferior to any other in applicability and usefulness as an auxiliary in gas manufacture. In this contest between the different types of plant and modes of operation, our position is absolutely neutral. All that is desired is that the best and most that can be said of any one shall be set forth fully and adequately. To this end. and for the purpose of eliciting further information, attention may—and it is hoped profitably—be devoted to Mr. Carter's criticism. Whether it will be profitable depends entirely on that gentleman. Conspicuous among his points is the statement that, by his Lowe water-gas plant, he is making 18-candle water gas for 10d. per 1000 cubic feet, compared with Mr. Brockway's 9·62d. per 1000 cubic feet of 16½-candle gas, produced by his Dellwik plant, and enriched by the gas made in the Peebles oil-gas retorts. This is a statement which requires for its better understanding that Mr. Carter should set out the items constituting the 10d. with the fulness that Mr. Brockway has the items which total to his figure of 9·62d. The difference in the quality of the gas, produced at practically the same price, is considerable; and in fact—all the conditions being comparable—this alone would put the combination of the systems as at Cleethorpes, from the water-gas enrichment point of view, once and for all out of the field. But are the conditions of Lincoln and Cleethorpes comparable? That is a point again on which Mr. Carter alone can enlighten us. The Cleethorpes plants—water-gas and oil-gas—are not by any means being worked on the most economical scale at the present time, simply because the demands on them are as yet comparatively small—not more than equal to about one-third of the capabilities of the water-gas plant and but a tithe of the oil-gas plant. As the two plants can be brought into more extended use, so will economy and efficiency accrue. If Mr. Carter will publish the items constituting his 10d., the prices of coke, oil, &c., the productive capacity of his carburetted water-gas plant per day, and the output when making gas at 10d., he will greatly enhance the interest attaching to his criticism.

Mr. Carter also asks that the best working of one plant shall be compared with the best working of another. We admit the force and justice of the request, providing always that the circumstances of operation of both have an equality. But there is another point of view, and that is the relative values of the plants under the worst conditions to which they may be subjected. The diuturnal experiences of a few years since are indelibly fixed in the memories of oil-carburetted water-gas manufacturers; and it is the remembrance of those times that has, we believe, largely turned the thoughts of gas engineers to the consideration of another type of plant and systems other than the Lowe of utilizing water gas, and in several cases, as the columns of the "JOURNAL" have shown, preference has been given to these. This is one of the points that weighed with Mr. Brockway—that the plant he adopted would enable him to turn with the utmost facility from one or other of these systems according to the state of the markets and the gas requirements of the times, besides having at his command the advantages of an oil-gas carburetting plant which could be used for either water gas or poor coal gas (without water gas) as occasion prompted. It is not forgotten that even the Lowe type of plant—Sydenham and Smethwick are known instances in this country—have been so fitted as to enable all this to be done, excepting the making of plain oil gas. The oil market it cannot be expected has arrived at a state of immutability; and the day may come when, with a change in the existing ease in that market, Mr. Carter may (his present disapproval notwithstanding) be found wooing his generator only, and showing an attachment to what has been contemptuously described as the "tricking" and the "juggling" of gases. In the at present unavoidable absence of a complete working statement from Mr. Brockway on the variety of modes of operation open to him, we have the figures from Ilford and Tipton; and while Mr. Carter is giving, if he will so favour the gas profession, the items constituting his 10d., perhaps he will say something as to how his working compares with the two towns named. We hope, too, that Mr. Brockway will, as soon as a fair period of working will enable him to do so, act upon Mr. R. G. Shadbolt's suggestion, and supply a second paper incorporating the results for comparison from the whole range of the possible uses of his plant. We believe that it is his intention, directly relief from immediate pressure will permit him to do so, to let down for a period his oil-gas retorts, and turn his attention to a working trial of what is now generally termed the Lewes process.

First place has here been given to Mr. Brockway's contribution to last Wednesday's proceedings simply because it surpasses in current general interest the other topics considered and discussed by the members. The other papers are of a very useful character; and both of them belong to that category of paper which does not give rise to disputation, but enables the members to relate, for the common behoof, their rule of action under co-ordinate circumstances. The first was by Mr. E. G. Smithard, who recounted his experiences during the carrying out of a sewerage scheme in King's Lynn in recent years. The paper and discussion will be very serviceable to gas engineers and managers who have to encounter the troubles which inevitably spring from such work. These troubles are an unknown quantity, and are so fickle in time and situation as to demand constant watchfulness and preparation. But sewerage works are a necessity of every well-ordered community; and so is, though perhaps not equally so, a supply of gas. Therefore, between the local authorities and the gas suppliers, there should be the utmost co-operation during the progress of work of the kind, but at the same time a full recognition of the rights of the owners of property already existing in the subsoil. There are local authorities who are, or affect to be, blind to their legal responsibility in respect of damage and loss which they may occasion; and herein is found the supreme difficulty produced by this public underground work. Local authorities, before they set up their backs against

their responsibility, could not do better than consider the portion of Mr. Smithard's paper dealing with this aspect of the question. Counsel's advice to the King's Lynn Gas Company is confirmed by the opinion of Counsel in connection with the Newmarket sewerage operations, the information upon which, as supplied by Mr. J. H. Troughton, forms a good supplement to the paper proper. On the other hand, actions-at-law and arbitrations over such matters as these are costly roads to justice, and do not conduce to future good relationship. If, therefore, by friendly conference, a fair compensation for any damage sustained can be secured, that, even if a part of the full pound of flesh has to be forfeited, is a small matter compared with the loss, for perhaps years, of the goodwill of the local authorities. In the case of King's Lynn, there was an amicable compromise of the Company's claims; and amity, as was seen on Wednesday, continues to exist between the Council and the Company. It is hoped that at Newmarket similar wise counsels will prevail.

The third paper was a description of a little device that Mr. H. Wimhurst has designed for facilitating the counting of the pence collected from prepayment meters—a work which daily is becoming a larger one for gas suppliers to reckon with. Of this, we need say nothing more. Nor does the other business transacted require mention, further than to remark that Mr. J. H. Troughton has had his long and prosperous services to the Association as Hon. Secretary crowned by election to the Presidential chair; and Mr. J. S. Dougall, who is of a good gas-engineering lineage, and whose brother is the President of the premier Institution, succeeds to the vice-presidency.

The North of England Meeting.

Though nothing so heroic as the sentiments which stirred the thoughts of the gentlemen who attended the meeting of the Eastern Counties Association cropped up at the North of England Association meeting at Newcastle on Saturday, there was ample provision of work-a-day subjects to satisfy the most active minded of those who spend and are spent in the carrying on of the great industry of gas supply. The two papers which were read—by Mr. J. Whyte, of Seaham Harbour, and Mr. E. E. J. Anderson, of Middleton, respectively—had received titles which, to a large extent, concealed their potentialities. That by Mr. Whyte, while it professed to simply raise a question of detail as to the construction of the flues of regenerators—as to which theories and practices exist in variety nearly as numerous as are the units of membership—really brought forward the much more important question of whether there should be flues at all, which, again, involved the question of whether regeneration is or is not an economical process in gas making. It is apparent, from remarks which are being heard somewhat freely at present, that the regenerator has fallen of late in the estimation of gas engineers. Mr. Whyte's setting deserves to be looked into, to see whether it really marks the discovery of a means for applying a principle in the construction of furnaces, or whether it amounts to nothing more than a structural improvement upon a setting in which the flues were (as suggested by the President) too small for the passage of the secondary air. On its merits, the paper was far from complete, as, in a question of this kind, dimensions, even to detail, are of essential importance. It, however, raised a discussion which will set many thinking—perhaps experimenting, and this, again, ought to lead to the settlement of the problem which, as yet, has been left unsolved. Mr. Anderson gave his paper the title of "The "Future of Gas." But all papers have for their object the imparting of information which will make the future road easier for those who have to tread it; so that he really gave too comprehensive a name to a communication which he acknowledged was intended to deal with the question of how to keep up to date in gas supply. With this explanation, it was an enlightened contribution to current literature on the subject. Not only did it serve to show up certain of the cobwebs which are now assiduously asserting themselves in the neglected corners of lighting and power supply, but it gave the sure footing of experience for the guidance of the many who are perplexed as to the lines upon which they are to continue their businesses, in times which are full of interests that do not run in the old grooves—including the supply of gas for power purposes and the lowering of the standard of the illuminating quality of gas. Mr. Anderson's remarks will not be taken as conclusive upon these subjects, but they bring to a focus facts which will be helpful to some who feel themselves at a point where there are undoubted openings for their energies, but which, without a lead, they may not have the courage to take. Both the papers were followed by profitable discussions.

The Supply of Cheap Gas for Power Purposes.

The letter by Mr. F. J. Bancroft on the pricing of a tender of gas for power, which we publish to-day, is precisely of the order of communications on this pressing subject that are chiefly to be desired at the present juncture. It deserves, and will doubtless receive, the particular attention of all gas-works administrators who are interested in the question at issue; and we sincerely hope and trust they will not keep their reflections to themselves, but—like Sir George Livesey and Mr. Bancroft—give all their professional colleagues the benefit of their ideas on the subject. Mr. Bancroft has advanced the problem towards a comprehensive solution; but he makes no claim to having solved it. Both his and Sir George Livesey's contributions are of the nature of a response to the challenge that was thrown down in these columns; and they are most valuable, apart from their merits, as keeping the discussion alive and on the right lines. It would be an altogether premature action on our part to intervene further at this stage of the controversy, if such it may be termed; and we can only join with Mr. Bancroft in requesting that the explanation and defence of largely differential prices may be forthcoming from some of the eminent suppliers of gas and electricity who are committed to them. We should dearly like to know how the Manchester Corporation can offer power at a discount of 75 per cent. or thereabouts on the price of a lighting service. The circumstance of the medium being electricity and not gas is only a matter for explanation. It is not a fundamental point of the business. We quite agree, and have always held, that the heavy discounts offered of necessity by many gas undertakings to large consumers of the mill or factory class, are an element of weakness to the undertaking as a whole, for the reasons clearly stated by Mr. Bancroft. They are, however, unavoidable in some localities, where it is a question whether the district shall be supplied from the gas-works of the mill, or the mill from the town works. This is the extreme case, and will serve for a point of departure. At the other end of the scale is London, which has so huge and diversified a gas demand that the special value of any one consumer, or class of consumers, to the undertaking as a whole can be expressed by a very small figure by way of discount. Broadly speaking, a residential district offers no field for a special discount system of trading in gas. Into the present discussion, therefore, considerations pertinent only to a residential district, or to undertakings so overwhelmingly large that they present the same conditions to the gas administration, do not enter except in the sense of negative illustrations. While for the present refraining from discussing Mr. Bancroft's points, it may be asked why it should be assumed that the cost of gas delivered into the distributing mains must be a constant. Does increased consumption only affect the distribution charges, in any case?

The Price of Gas Coal.

The subject of gas coal prices is very much in evidence just now, when some of the largest Metropolitan and other contracts are being settled. We understand that, so far as arrangements have been made, the Northern price this year shows a reduction of at least 9d. per ton on last year's rate. It is quite possible that the fall in value may go to a higher figure, for reasons of which the acute gentlemen who have gas coal to sell are perfectly aware. The chief of these is the reduced requirements of the largest buyers, especially the London Companies—using the description in the larger sense. It is well known that in nearly every case—certainly in that of the biggest undertakings constituting the London market—they considerably overbought in the past year. The increased gas consumption for which provision was made did not come to pass, with the result that the coal remained uncarbonized. Whether this contraction of demand was due to the mildness of the season, to the increased popularity of incandescent burners, or to the competition of other illuminants, is immaterial in this connection. The fact remains that the purchases of gas

coal in the London market this year will in all probability be as much as 500,000 tons less than those of last year. This is sufficient reason for expecting prices to turn in favour of buyers.

On the other hand, it is equally true that trade is brisk in those departments which usually absorb so much coal as to materially influence prices. The iron manufacturer is busy once more, even in certain of those branches wherein the rivalry of steel has been severely felt of late years. Wrought-iron plates are actually looking up again, especially for ship-building. Shipping itself is in good employment, especially British bottoms, which are beating the bounty-fed mercantile fleets of other nations. The coal consumption of the iron manufacturer is so enormous, that even the demand for gas making is a long way behind, and has to submit to its lead as a price regulator. For this reason, there is not likely to be anything like a "slump" in gas coal prices, though they are bound to weaken. Another pertinent consideration here is the price of gas oil. This has for some time been cheap —cheaper, indeed, than it has been plentiful. But now the value of oil is on the rise; and the cause of this movement, whatever it may really be, is not the demand of British gas-works. Crude oils are worth more money in their places of origin, and probably will be in greater demand if the newer fields should turn out failures. This will drive many gas managers back upon coal.

Yet, once more, we do not believe the British gas industry as a whole has felt the full influence of the incandescent gas-burner. The falling-off in gas consumption, due to the economy of this means of lighting, has only just begun to assert itself. It will be more marked still before the tide turns again; and this is an additional reason why gas companies should push the sale of their staple for all purposes. Unless the increased consumption by stoves and engines overtakes the saving by incandescent burners, there will be for some years a check to the development of gas supply outside such exceptionally fast-growing districts as Tottenham and Edmonton or Ilford. We state this in order that the nature of the phenomenon may not be mistaken when it appears. Meanwhile, the effect will be to check the sale of gas coal and bring down prices. In this way the consumers of gas will reap the benefit of their economy in a way unknown to themselves, but not unfelt in connection with the cost of manufacture. For, after all is said and done, a plentiful supply of good and cheap coal is the best aid to the production of cheap gas.

The Papers of the Educational Fund of the American Gaslight Association.

Mr. Alfred E. Forstall, the Secretary of the Trustees' Gas Educational Fund, formed by the American Gaslight Association to extend and improve the technical instruction of followers of the gas industry, has just forwarded to us a complete set of the questions and answers sent out for the three years' course of the "Practical Class, Third "Section," of students. For this valuable mass of printed matter, of which we shall, of course, take jealous care, our best thanks are due and are hereby given to the Trustees and to their ever-courteous Secretary. It is very greatly to be regretted that no exchange in kind is yet possible from this side; but this default may be made good by-and-by, seeing that the forces of the profession in Great Britain are once more united for good work. It appears that the experimental period for which the original subscriptions were bestowed has now expired; and the Trustees of the Educational Fund in question have to consider the necessity of giving an account of their operations, and promoting the continuance of the scheme for a still further period. There ought not to be any difficulty about this. By all accounts, the one thing that the American employer appreciates in his skilled workmen and their technical leaders is educated intelligence. By "education" he does not mean the effect of such scholastic and collegiate life as we are traditionally accustomed to call by this name here in England; and by "intelligence" he does mean capacity to learn as well as ability to apply. Of course, if the Trustees had misused their funds and opportunities, these would not be restorable; and if they had found their labour and solicitude uncalled for, they would not care to carry it on.

As regards the quality of the technical instruction enshrined in the papers of the Educational Fund, it is impossible to speak in too high terms of commendation. It would not be a simple task to pick holes in the practical science of such men as Mr. Walton Clark (the Chairman), Mr. Eugene Vanderpool (the Treasurer), or Dr. A. C. Humphreys, who is a member of this body, which contains other names of equal repute in the profession. They have put their knowledge into the papers with an obvious sense of responsibility for training the learner in the way he should go. The questions and answers are very much to the point, searching, and thorough. They are not for mere certificate hunters. If fault must be found, it will be that perhaps the Trustees have shown a tendency to assume too much knowledge on the part of the learner, and have therefore made some of their questions rather too sweeping. Anyone who could reply to all their queries in the full sense of the answers prepared would not have much more to learn about gas making. A little spoon-meat might with some advantage be mixed with the strong fare ordinarily provided by the Trustees. A good plan for making the ground sure in advance is to frame the question, write it down carefully, and then see how far it might be broken up. For example, here is a question which demands a treatise for an answer: "What precautions should be taken to avoid spontaneous "combustion in bituminous coal stored in a coal-shed?" The putting of such a portmanteau-question is a sign of the over-eagerness of the well-instructed mind of the querist. It might have been better to ask the learner first what he understands by the term "spontaneous combustion." This criticism is not, of course, inspired by lack of appreciation of the Trustees' work, which elsewhere exhibits the highest solicitude for the leading-on of the student from the simple to the complex. Nevertheless, we cannot but regard the papers, as a rule, as decidedly "stiff," which has the effect of making the complete set a repertory of technical information of the highest class. Not the least of the merits of this excellent matter—if the Trustees will pardon the observation of a mere "Britisher"—is the good English in which it is written. There is never the slightest difficulty in understanding what is meant. This is due to the simple circumstance that the writers have been content to employ English words in the accepted English sense, and do not despise the art of Lindley Murray like so many of their countrymen. For this mercy the Trustees certainly deserve the gratitude of the whole technical world which speaks English—or would do so if it could.

The Welsbach Reorganization Scheme.

If the new Board of the Welsbach Company were asked to-day for an illustration of the truth of the saying that "the downward road is an easy one," they would, we fancy, without hesitation point to the documentary statements—comprising their first complete annual report, the details incorporated in their reconstruction scheme, and the estimate of the value of the Company's assets—which they issued to the proprietors at the close of last week; and in their labours of the past twelve months they would find a striking example of the difficulties which beset reform and the retracing of misdirected steps. In the retrocession sometimes one, sometimes many, suffer; and in this case it is the poor deluded proprietors whose scrip, bearing a face-value of £3,479,539, has been adjudged by the Board to be valueless to the extent of no less than £2,134,539! In other words, the Board assert—frankly and convincingly—that, taking the most benevolent view of the Company's position and prospects, the capital value of the enterprise to the proprietors to-day is no more than £1,345,000, of which only £450,000 is represented by the present worth of the assets, and £900,000 by "goodwill." The latter is a liberal valuation of such an intangible asset; but the Board have been guided, not by the value of the real assets, and not by the value placed upon the stock and shares by the market (which is rather more than £885,000), but by the sensible rule that "the capital should be written down to an amount on which it is reasonable to expect that, under existing conditions, dividends may be earned." Their report shows how far they have adequately interpreted this fundamental principle on which the plan for reorganization has been drawn.

Profits and Prospects.

Let us see. The accounts show a profit for the past twelve months of £51,908, from which has been deducted £6050 in respect of debenture interest—leaving a balance of £45,858.

Detaching themselves from the old plan of taking credit for dividends from the Austrian Company before they were paid, the Board have decided to include them only in the year in which they actually receive them. It is true these dividends have been on a descending scale; but whatever they are, will they go to swell the profits from the English business. The policy of the Directors, both in retrenchment and trading method, is having an effect, too, which even the most sanguine of their number could hardly have anticipated. The extravagance of the former Directors is reflected in the statement that, under the heads of administration and distribution alone, an annual saving of above £50,000 has been secured. The maintenance of a large and unnecessary retinue of officials was one of the foibles of the old Board, for which the proprietors had to pay dearly. The saving in this direction is good; and a fairly intimate knowledge of the Company's affairs allows the expression of the opinion that the sweeping out of the highly-paid functionaries of the past, and the concentrating of the management, have not been followed by a depreciation of efficiency, but on the contrary there has been a marked gain. This £50,000 exceeds by some £20,000 the concessions which the Directors wisely made last year in the price of their wares; and when it is remembered that on the previous year's working of the English business there was a net loss of £29,678, and the year before of £3196, the net profit last year of £45,858 must be regarded as excellent, showing as it does a steady growth in trade. Taking this figure as a low estimate of the net profit-earning power of the Company to-day, adding the dividend from the Austrian Company, and taking into consideration the fact that the Company are now in possession of liquid assets amounting to £167,500 (which the Directors are advised cannot under present circumstances be lawfully distributed), as well as the encouraging prospects of the trading under the administration to-day, it is pretty safe to predict that the proprietors are, if the scheme of reorganization is ratified by them, on the border of a new dividend-paying era. Under the scheme, when the available profits amount to £73,250, the Directors will be in a position to pay the full dividend of 6 per cent. on the preference shares and make a distribution of 5 per cent. on the ordinary shares.

The Division of the Capital and Other Points.

All the details of the proposed rearrangement of the capital are published elsewhere in this issue; and the merest outline will suffice here. The new capital, if the scheme is approved, will consist of 600,000 6 per cent. cumulative preference shares, and 745,000 ordinary shares of £1 each. The existing preference holders are to receive all the new preference shares, or 40 per cent. of the present holding, and 375,000 new ordinary shares, or 25 per cent. of their present holding. The existing ordinary holders will receive 337,500 new ordinary shares, or 25 per cent. of their present holding; and the deferred holders 32,500 (of which 1024 will remain unissued) of new ordinary shares, or 5 per cent. of their present holding. That the abandoning of such a large percentage of their capital is the best that the Directors can recommend if the proprietors desire the concern to return to a prosperous and dividend-paying state, discloses the disastrous position into which it had been brought under the old *régime*. The scheme is a good piece of statesmanship; and the candour displayed by the Board (who in this uncongenial business have had the co-operation of the Advisory Committee) throughout their statements gives to the case for reconstruction on the suggested lines a strength which it will be difficult to resist, unpalatable though the proposals are bound to be to a section of the proprietors. The references to the terrible depreciation of the value of the Company's investments in Austria, and to that long-used stimulant of drooping hopes—the osmium lamp—which the Board laconically says "is *still* in process of development," are points in the statements which will interest not only those directly concerned, but those who have followed the remarkable delusion which seams the history of the Welsbach Company. The wisdom of the new direction has accomplished marvellous things in the past twelve months; and the acceptance of the reorganization scheme is the indispensable condition to further development and the attainment of a dividend-bearing prosperity.

The Sad Case of Dublin.

In the present financial position of the City of Dublin, the local Press has, for once in a way, discovered a question on which something approaching unanimity of opinion is possible. First the report of the Departmental Committee appointed to investigate the working of the Municipal machinery, and then the rise of 1s. 1d. in the rates (to which reference was made in the "JOURNAL" a fortnight ago), have caused a feeling of widespread alarm, and a pardonable curiosity to know what will be the end of it all. The rate of 11s. 2d. in the pound which will this year be levied on the north side of the city, would seem sufficient to convince even the most rabid supporters of the Corporation of the need for reform; and it is exceedingly doubtful whether even this stupendous tax will suffice in the future to meet the obligations of the city. So far as Dublin is concerned, it is impossible to believe that the citizens will be any longer contented to sit down quietly and let their affairs be mismanaged for them in the way they now are; but whether or not they are roused to action, their unfortunate case may be cited as a clear warning to others. It may be necessary for all of us to learn from experience; but surely there is no reason why it should not sometimes be the experience of other people that teaches us. In Dublin, what is needed is the "cure" of an existing trouble; but in many other places where a policy of reckless extravagance is in contemplation only, "prevention" may be possible. We all of us know which of the two things is to be preferred; and that is the one which should be striven for.

How Trouble is Made.

It may at once be admitted that the Dublin Corporation are not responsible for all the expenditure to which the city is put; but in one instance at least their conduct has been exceedingly blameworthy—that is in starting a costly electric lighting installation at a time when the ratepayers were already greatly overburdened. There was not, and could not have been, any real necessity for such a step; and the result has been what any intelligent person might have expected—present subsidies from the rates and future estimates of profit. As has previously been pointed out in the "JOURNAL," the electric lighting accounts are to be assisted to make a good showing by adding some £6000 to the outlay on public lighting, by dispensing with certain gas-lamps and putting up arc lights in their stead. Could greater folly—one might almost say madness—be imagined? Here is a city, already plunged heavily in debt, which indulges in a purely speculative scheme (and a none too hopeful one at that) in the shape of an electricity undertaking, and then asks the citizens to pay £2 for work done by their own plant which the Gas Company have hitherto performed for £1 or less. Such a course seems to be totally indefensible; but we are quite prepared to learn from our municipal trading friends that it is necessary for the benefit of the community, and is not (as a Dublin paper remarks) "a classical example of the operation known as feeding a dog with a bit of his own tail." Electricity is quite as expensive a luxury in Dublin as elsewhere; and the unhappy citizens are not in a position just now to afford luxuries.

Manchester Gas Profits

Let us, however, turn from consideration of the melancholy figure cut by the Irish Capital as regards financial matters, to the more inspiriting subject of the Manchester Corporation Gas-Works. Here we have a profit of no less than £137,000 on the working of the year ending March 31, or nearly £60,000 more than was anticipated by the Committee twelve months ago. For this excellent result, a large saving in the cost of coal is to a large extent responsible, while residuals have commanded high prices. As usual, the sum of £50,000 is to be taken from the profits in relief of the rates, making the total amount utilized for this purpose since the works were acquired by the Corporation in 1844, £2,559,301. This is a truly regal return to the citizens generally for any risk they may have run (theoretically) in undertaking the business of gas supply; and we are therefore glad to see that the consumers are also to receive some consideration, in the shape of a reduction in the price of gas. This reduction of 3d. per 1000 cubic feet (together with the abolition of rental for the hire of gas-cookers) will represent a saving to consumers of £61,000 a year, so that they are to enjoy a very substantial share of the prosperity of the concern. As to whether this is all they are entitled to, there will doubtless be two strong opinions—that of the ratepayer who does not burn gas, and that of the consumer himself. It does, however, seem to us—more particularly

bearing in mind the enormous sum already contributed to the rates by the consumers of gas—that a still greater reduction might safely have been made.

And Electric Lighting.

An interesting, and very significant, feature of the electricity accounts is the fact that the amount to be raised in the current year's rate for street lighting is £400, compared with an outlay of £500 for this purpose last year. Here is food for reflection on the part of the Dublin City Council. The Manchester Corporation estimate a deficiency of nearly £10,000 on the current year's working of their electric lighting undertaking; and yet they do not regard it as necessary to indulge in an extravagant system of street lighting by means of arc lamps. They are satisfied that gas is the more suitable for the purpose; and so also seems to be the "Manchester Courier," for it remarks: "Perhaps a full exchequer will prompt the street lighting authorities to work in harmony with the tramway authorities, and to allow the gas-lamps to continue lit in such places as Albert Square as long as the tramcars are running. The electric arc lamps may be of use to would-be suicides, for hanging purposes; they are of little value to law-abiding citizens desirous of finding their way about."

WATER AFFAIRS.

Officering the Metropolitan Water Board.

At their second meeting, which was held on Thursday, the Metropolitan Water Board decided, by a majority of eleven, that their Chairman and Vice-Chairman should be unpaid; and the appointment of gentlemen willing to undertake the responsible duties attaching to these offices for the honour of holding the positions will be the first business when the members re-assemble on Thursday next. It appears that there are several candidates for the posts; and the selection may be expected to give rise to some lively scenes. An important feature of the proceedings last Thursday was the consideration of the Committee's recommendation that a Clerk should be appointed, at a minimum salary of £1500 per annum, and that he should be the "chief official" of the Board, and be engaged only during their pleasure. There were two points in this recommendation which aroused the indignation of certain members—the high salary and also the high status which it was proposed to give to the Clerk. That he should be called the "chief official" was more than could be tolerated; and eventually the recommendation was adopted *minus* the sentence containing the offending words. An attempt was made to cut down the Clerk's salary by one-third; but we are glad to find it was unsuccessful. We know that it is the firmly-rooted opinion of one prominent member that no man (himself, perhaps, excepted) is worth more than £500 a year; but we doubt very much whether the type of man who will be required to direct the business of the Board could be obtained for less than three times this amount. Until the undertakings of the Water Companies have been acquired, a large establishment will not be needed; and so no other permanent officer will be appointed at present. The Board, of course, require a temporary home; and the question arose as to whether they should continue to use the Caxton Hall, Westminster, or accept an offer of the Metropolitan Asylums Board of the use of the room in their building on the Thames Embankment. In the result, a recommendation of the Committee, that the use of the Council Chamber and certain rooms at the Caxton Hall should be obtained, on terms to be arranged with the Westminster City Council, was adopted. By this day week it may be expected that the appointment of Chairman and Vice-Chairman will have been made; and that of the Clerk should follow with as little delay as possible, as the first meeting of the Arbitrators takes place on the 29th prox.

We have received from the Sanitary Publishing Company "The Construction of Roads, Paths, and Sea Defences," by Frank Latham, M.Inst.C.E., Borough Engineer and Surveyor of Penzance. The book is a reprint of a series of articles written for the "Sanitary Record and Journal of Municipal Engineering;" and it deals, among other matters, with private street repairs, specification clauses, prices for estimating, and gives engineers' replies to queries. Approximate prices of road-making materials are furnished in an appendix; and there is an index.

ESSAYS AND REVIEWS.

THE GAS AND WATER STOCK MARKET.

(For Stock and Share List, see p. 239.)

The course of things in general on the Stock Exchange last week was somewhat chequered, as varying influences came to the front; and it was affected at different times by good news and bad. It opened cheerfully, and was going along nicely, although business was not over brisk, when the Somaliland incident gave it a check. This was rapidly succeeded by the Budget announcement, and then things took a firm tone, which lasted fairly well to the close, although met here and there by realization to secure profits. Prices in general showed a good advance; Consols being conspicuous in the movement. The Money Market was easier at first; and there was a good deal of reckoning on a reduction of the Bank rate on Thursday. But once more it failed to come off; and so the market stiffened up and closed firm. Business in the Gas Market was only very moderate, not even the principal issues coming in for much attention. But still there was enough to show that the tendency was decidedly favourable to ordinary stocks, though debenture issues were rather flat, and fair improvements were made in several quotations. As to the position and prospects of gas companies in general for the current half year, the results of the first quarter would seem to be good, especially when the unusually mild weather is taken into account, which forbids the expectation of a large quantity of gas being sold. In Gaslight and Coke issues, the ordinary was rather quiet, and very steady at close prices, which were the same at the opening and the close. The secured issues were more noticeable; the preference had a smart recovery, but the debenture fell a point. South Metropolitan was very quiet, and unchanged; but the debenture moved down one. In Commercials, the 4 per cent. changed hands once or twice at poor figures. There was no business to speak of in the Suburban and Provincial group, and hardly any movement in London, except that Southampton, which had been put up the week before, was now put down again. But in the Provinces, Sheffield had a smart advance, and Liverpool a small one. A few transactions comprised all the business in the Continental Companies; and they were quite devoid of feature. In the remoter world, Buenos Ayres and River Plate were on the rise. The Water Companies had such a shake up as they have not had for many a week, and were much more lively and interesting than the Gas Companies. Last week it was the turn of the open stocks to advance; the debenture issues having already been promoted. Nearly all had a smart advance, and Southwark, which had opened at 209½, actually changed hands on Saturday at 233—a difference of 23½!

The daily operations were fairly level in point of value; and the movements were: On Monday, Southwark rose 3, and ditto "D," 5. On Tuesday, Southampton gas fell 2. In Water, Grand Junction gained 2, Southwark 7; and ditto "D," Chelsea, and East London 5. On Wednesday in Gas, River Plate debenture rose 1, and Gaslight preference 1½; but ditto debenture fell 1. In Water, Lambeth 7½ went up 5, Southwark 3, and East London 2. On Thursday, British rose ½, and Buenos Ayres and River Plate ¼; but South Metropolitan debenture fell 1. In Water, Southwark moved up 2, and East London 1. On Friday, Brighton original rose 2, and River Plate ½. In Water, Kent, Southwark, and West Middlesex rose 5, and Grand Junction 1. On Saturday, Gaslight preference gained 2; and in Water, Southwark 3.

THE PREMIUM SYSTEM OF PAYMENT FOR LABOUR AS AN ANCILLARY TO PROFIT-SHARING.

There must be greater difficulty than appears on the surface, in the way of the general extension among gas workers of the profit-sharing system of paying for labour. So much is to be deduced from the patent fact that the system does not spread as its declared merits would lead one to expect. We shall not attempt to guess at the nature or the importance of these obstacles, but will only go so far as to admit that, in the important class of municipal gas undertakings, there is a formidable objection to the recognition of any claim on the part of the workers to a proportion of profit which may either be supposed to be non-existent, or to belong to someone else. In other cases, doubtless, the paralyzing query of whether it is "worth while" to enter into a complication of this kind, has found the only too easy negative answer. Here let it be conceded also that the occasional abandonment of profit-sharing by firms that have tried it, on the score that it has not been found to answer, is a great discouragement for others who might take their experience for an example. It were idle to reproach these victims of a disappointment which one may be sure was none of their seeking; but there is no denying that every such instance is made the most of by those who profess their inability to see any advantage in profit-sharing. Between those who have found it not worth while to continue the system, and those who have never tried it because they

suspected as much, profit-sharing is as betwixt the hammer and the anvil.

Yet, one may ask in the circumstances, Is this to be the end of the experiment? Granting that profit-sharing is not the only plan, while allowing it to be the best plan yet devised to interest the wage-earner in the proceeds of his toil, is there no other hope? The answer need not be a flat negative. The question is really one of degree. Assuming that profit-sharing and copartnery constitute together the fullest measure of deliverance of the worker for wages from the status of the hireling, who cares not for the issue of his labour—assuming even that there is no other expedient known for acquiring the good-will of the worker as regards his employment—it is not wise to reject the criticism of those who object that the benefit in question is too diffused and remote to operate in all cases directly in the requisite sense. Besides, it can be, and often is, urged in argument that, desirable as it may be for the employer to have the good-will of his workpeople, it is not this to which he must look in the main for the profits of his business.

Not to go into these matters, which are sufficiently hackneyed as topics of discussion, let us devote attention at once to the method of rewarding diligence on the part of the worker which is known as the "Premium System." It is possible that some such system may be adaptable to gas manufacture, even where there are no gross profits to be divided. The "JOURNAL" was one of the first of English technical periodicals to recognize and acknowledge the merit of the innovation; and we need therefore make no apology for returning to the subject. It is of no use to grow tired too quickly of repetition, if a cause is to be pushed through a heedless world. The premium system, let us therefore explain, is not profit-sharing. It is merely a device for encouraging the workman to put forth his very best endeavour to get through a job in the shortest possible time, by paying him an extra wage determined by the amount of time saved. If, for instance, the time usually spent upon a given job is 100 hours, the man who completes it in (say) 50 hours receives an agreed share of the saving, calculated at the ordinary wages rate. There are several varieties of the system in use, and in greater or less repute; and there will necessarily be many more, as the principle is extended to various departments of industry. It is not limited to one or a few trades; and the element to be economized may also be changed in different cases. In its simplest form, however, it applies to the saving of mechanics' time on definite jobs. The essence of the system—whether the method of applying it is that of Rowan, or Weir, or Halsey—is always the same. Every man earns his own reward; and he earns it immediately, and is able to see it for himself. One system may answer in a particular place better than another. That named after Mr. Rowan was described in a paper read at the Glasgow Engineering Conference in 1901, and again recently at a meeting of the Institution of Mechanical Engineers. Those who desire information on matters of detail must consult the original papers, particularly the later one, which contains some highly instructive hints as to the timing of jobs—a serious business for all employers.

It is for the employer to set the time allowance for the job, in which he will, of course, be guided by experience. It is a little more difficult when the men are paid by the piece; but this can be translated into hours, and the time and money equivalents ascertained. Usually, speaking on general principles, the time taken to do most jobs can be reduced, or more work can be done in the time; and the premium system gives the workman a share of what he can save in this way. If no time at all is saved, the workman gets his ordinary hourly rate of wages; so that nothing happens. The men cannot lose money at it, although they may gain—an important consideration. By the Rowan system, the amount of premium bears the same relation to the ordinary wages due for the job as the time saved bears to the time allowed. Thus, if he saves one-twelfth of the specified time, he has one-twelfth added to the amount of his wages paid for the time actually worked; and so on. The rate of wages is not affected; and a man can never earn double his ordinary wages. Messrs. Barr and Stroud, of Glasgow, who were the first to introduce the system, have found it expedient to issue to their workpeople an explanatory pamphlet as to its working, which the firm will doubtless communicate to other employers.

Of course, when the system was first heard of, the Trade Unions made haste to condemn it. They argued as follows: "A man is tempted to do his job in half the accustomed time, by an offer of one-half of the amount of wages saved. This means that one man is to do the work of two, taking the bread out of the other's mouth, and only getting half his earnings. He would be a fool to do it." This is a particularly clear bit of Trade Union and Socialist logic; and it is satisfactory to know that, notwithstanding the symmetry of the argument, the Unions have not been able to resist the introduction of the premium system of rewarding that diligent labour which is to them *anathema*. The reason is simple. Whatever the Unions may pretend, the men who actually work know that there is no such thing as a fixed lump of labour, at which all can cut and come again, like a pudding. Two men cannot do the same job, no matter in what time it is done, because they cannot stand in the same place. If a man takes twice as long over a job as he need do, he does not make a two men's job of it, but incidentally renders such jobs so dear that their number is restricted, and his own services are dispensed with on the first convenient occasion. Conversely, by how much soever a job is cheapened, there are certain to be more of them to do. Consequently, if a man can cheapen and increase the output of a works, not only without hurting himself, but actually to his own immediate advantage, he is thereby helping to find more work for others. That is sound common sense, worth all the Communistic claptrap in the world.

In the course of the discussion upon the premium system of wages payment, much mention was necessarily made of piecework; and a great deal for and against it was advanced from the respective standpoints of employers and workpeople. It is hardly necessary to point out that there is nothing in piecework opposed to Trade Union principles, since some of the strongest societies in existence are in connection with trades in which everything is done by the piece. Still, it is true generally that Labour politicians dislike piecework, on the ground that it demoralizes and oppresses those who submit to it. Employers also are blamed for cutting down piecework prices when men are found to earn high wages, and so destroying the incentive to increased effort. This is a very large question, as much social as industrial; and it is extremely difficult to deal with satisfactorily. It is quite possible (as there is only too much experience to show) for men to earn too much money; and piecework, by its immediate reward in cash for extra exertion, ruins many workmen. It is impossible to repel the suspicion that the same drawback adheres to the premium system. There is no guarantee, in the system itself, that the recipients of the bonus will have any inducement to make the best, or even a reasonably good, application of the money. The best workmen will naturally derive the largest benefit from the premium on despatch; and such men are proverbially not always the most trustworthy when in funds. This is a weakness of the system which it does not contain any provision for meeting. It was mentioned by Mr. Yarrow in the discussion on Mr. Rowan's paper; and, in reply, the author stated that the system had, in his experience, improved the men, who had become more regular in their work. He is fortunate in this respect; for it is only too easy to conceive of a very different effect being produced by the same cause. Obviously, it would be possible to engraft upon the system a method of deferred pay, or investment of the bonus.

It is the standing objection to the introduction of piecework into trades previously carried on by time, that practically the men are never allowed to earn more money by their extra exertions beyond a certain point, at which the price is always cut down by the employer on reletting. Thus the work falls into a vicious circle, which in the end proves like a grindstone to the faces of the workpeople, of whom none but the strongest and most expert can earn more than a starvation wage at it. The fault may be admitted; but it is not easy to frame a universal remedy in the face of competition which presses hard on employers and workpeople alike. If an employer goes on paying more for the labour on a job than it is worth in the open market, he will be underbid on his tenders. There is no artificial preventive of this effect. A Socialistic buyer like the London County Council may insist on a British firm tendering for their wants paying the Trade Union rate of wages; but if it suits their purpose, they will go abroad for their supplies. Like piecework, the profit of the premium system to workpeople must depend entirely upon the rate fixed by those who give out the work. This is usually done, or suggested, by the foremen, who have a keen sense of the value of labour. There must always be the initial difficulty of making a fair rate. As already observed, time can generally be saved on a daywork job, which means that if the rate is based upon this datum, the men will be able to get a rise forthwith. The trouble afterwards will be to get the men to do their best, with no after-thought that they may be cutting their own throats. There must consequently be a rigid rule that the rate once fixed will not be lowered, which is a challenge to human nature.

It is possible that, as Professor Barr has said, the incidental gains of a system of rewarding labour which pays for greater diligence and despatch on the part of the individual workman—without necessarily engaging his good-will on the part of the employment as a whole—may be even more valuable to the employer than the direct effect. Not only is it made the interest of the workman to improve, but weak places are found out, and better methods encouraged. It is an axiom of works management that the men can always save a great deal if they like. When paid by wages pure and simple, there is no inducement for them to do this. Indeed, if they have become saturated with the poisonous doctrines of Socialism, and habitually regard their employer as their natural enemy, the influence is all the other way. Profit-sharing is intended for a corrective of this pernicious error; and it does it, so far as its operation is brought home to the inner consciousness of the participants. The question of whether, and how far, any other system of payment for labour subserves the same great end is crucial. For the present it remains open. Our object in thus discussing the subject is to remove the impression that there are no means of engaging the interest of the workman in his employment where the invention of profit-sharing for gaining his good-will appears not to be available.

The second session of the Petroleum Institute will close on Thursday, when the Principal (Dr. Dvorkovitz) will deliver the final lecture, on "The Petroleum Fields of the Far East." After the lecture there will be a meeting of the members and friends of the Institute.

THE GRANTON WORKS OF THE EDINBURGH AND LEITH GAS COMMISSIONERS.

DESCRIPTION PREPARED

BY

WALTER RALPH HERRING, M.INST.C.E., *Engineer.* *

ARTICLE XVI.—Accompanied by Plate No. 17, illustrating in Plan and Side and End Elevations the General Arrangement of the Coke Conveying, Storing, Screening, and Loading Machinery of the 1000 Tons per Day Carbonizing Plant, outside the North End of the Retort-House.

COAL AND COKE HANDLING PLANT.

The general arrangement of the coal and coke handling plant has already been illustrated on various plates, particularly Nos. 9 and 13. The coal-handling plant has also been generally referred to when dealing with the carbonizing plant in particular. It may, however, perhaps be of service to again briefly describe the complete system.

The coal arrives at the works by rail. Arrangements have been made for the discharging of waggons of any capacity up to 40 tons. There are two lines of railway sidings on the west side between the retort-house and coal-store supplying the retort-house with coal. About the middle on the transverse centre line of the retort-house a 6-foot steel belt conveyor is sunk in a trough beneath the rails, and running transversely to the lines of rails. The distance from the rail level to the surface of the belt is about 3 ft. 6 in. The trough under the rails is formed with sloping or hopper sides, and measures 13 feet across at the top; the rails being carried over the trough on girders, which have been introduced of sufficient strength to carry the heaviest possible load likely to pass over the opening. The bottom of the hopper, consisting of a steel-belt conveyor, is really a feed for the coal-breakers; the speed of this belt being varied at the will of the operator to anything desired up to the maximum capacity of the elevators.

Hopper waggons, with bottom doors, are discharged by allowing the contents to fall through the bottom door opening into the feeding conveyor beneath. However, the majority of waggons in Scotland are fitted with one end door. To discharge these with a minimum of labour, the hydraulic system for rearing one end of the waggon and discharging its contents on to the feeding-belt has been introduced.* Waggons varying from 5 to 15 tons capacity are now common in this district; and the discharge of the one is equally as easy as the discharge of the other.

The tipping arrangements consist of a hydraulic ram (Plate No. 18, fig. 1†), which is sunk between the rails in such a position as to be a sufficient distance outward from the hopper to ensure the contents of the waggons discharging freely thereinto. This was illustrated upon Plate No. 9, fig. 4; and, in more particular detail, on Plate No. 18. The head of the ram is forked, and has a bearing surface on the axle of 12 inches. This is placed sufficiently low between the rails to permit of the works locomotive passing freely thereover. The ram is $7\frac{1}{2}$ inches in diameter, and has a fixed stroke of 6 ft. 6 in. Hydraulic capstans are arranged for bringing into position the waggons to be discharged. A slight groove is cut in the rail for the waggon-wheels to enter, indicating the exact position beneath the ram.

By the movement of a lever, hydraulic pressure is admitted to the cylinder; and this causes the ram to rise—the forked end, coming in contact with the rear axle of the waggon, carries this with it, raising the waggon to an angle varying between the horizontal line and 40°. The raising of the rear axle of the waggon in a perpendicular line causes the forward wheel to draw inwards towards the ram. The catches securing the end doors having been previously released, the rearing of the waggon brings about the discharge of its contents through the end door on to the conveyor beneath. The empty waggon is then lowered, and pushed forward towards the yard to the coke-handling plant by the next full waggon brought into position. The discharging of one waggon in five minutes is a very simple task; and as provision has been made for discharging four waggons simultaneously, the plant is consequently capable of discharging coal at the rate of 500 tons per hour.

The breaking of coal at the Granton works is rather a formidable factor, using as we do 33 per cent. of cannel of the roughest character so far as its physical characteristics are concerned, apart from a large proportion of hard grained coal. Notwithstanding the fact that I gave prolonged and careful consideration to the question of the type and the proportions of the crusher to be introduced, I frankly admit that I under-estimated the requirements. It is desirable that the coal unloading, breaking, elevating, and conveying operations should be confined to an average eight-hour day. The maximum capacity of the house is 1000 tons per day, so that our uniform average would require us to unload and handle 125 tons of coal per hour. Allowing for shunting operations and the general incidental delays on a works of this magnitude, 150 tons an hour was a small enough average to allow for. 150 tons of coal per hour represents 250 cubic yards per hour, or 4 cubic yards per minute—a volume of work which is no doubt considerable, and requires spacious and substantial plant to deal with it. Experience has proved that our first type of breaker was insufficient to meet our somewhat exacting requirements. Besides, as chance would have it, a class of cannel that had never hitherto been procurable at reasonable rates in our own market, was offered and purchased in fairly large quantities last year—a cannel which arrives at the works in pieces, the majority of which are fully the size of a man's body. Soon after starting operations, therefore, I discovered that the crushers was insufficient to deal with the quantity required; these large pieces occupying the whole crusher at times; and taking a few minutes to break sufficiently on the main top rollers to enable the bottom ones to deal with it. Operations, however, had to be continued; and we therefore handled the crushers very carefully during the periods of breaking, both on the day and night shifts, and immediately set to work to devise a newer type of a larger capacity equal to handling the enormous volume of material within the period required. This crusher is illustrated in Photographs Nos. 76 and 77. The crushers are in duplicate, and consist of three tiers of rollers—the upper ones being of such a form as to bring about a crushing effect similar to the reciprocating motion of a Blake crusher; while, by arranging the peculiar form of teeth on revolving spindles, it enables a piece of material to fall between the crushing jaws, measuring 2 feet by 3 ft. 9 in. by any indefinite dimension otherwise, as the maximum. The next tier of rollers is of a different form, and intended to reduce the larger pieces to such a size as will enable the bottom rollers to finish the work. The bottom tier consists of two pairs of rollers, studded with diamond points; these being arranged so as to reduce all that falls through to the size required for the plant. The rollers themselves consist of cast-steel discs threaded upon a 6-inch square shaft, the shaft running in cast-steel brass bushed bearing blocks fitted between the frames on either side, and extending to the outsides, and fitted with cast-steel gear wheels—each roller being therefore double geared.

The frame or body of the crusher has been constructed, so as to permit of the easiest and most rapid replacement of a set of rollers in case of a mishap without disturbing those above or below it. The side frame is built up of angle and channel steels, with $\frac{3}{4}$-inch plate riveted on either side (see Photograph No. 77), forming, as it were, a number of short box girders. The cast-steel brass bushed bearing blocks have projecting fillets on their top and bottom sides, which are made to rest upon these short box girders, not only forming the distance pieces between them, but also acting as supports for the upper tiers of rollers. The side frames, when once placed in position, are further secured together by means of long bolts. As far as described, the crusher consists only of side frames with the tiers of rollers between. In order to facilitate the rapid removal and replacement of a set of rollers in any tier without disturbing the side frame, the front and back frames are formed by inserting short pieces of steel joisting forming distance pieces between the various tiers of rollers as well as back and front frames. In the event of a break-down (say) of the middle set of rolls, all that is required is the removal of the short piece of joist immediately opposite the bearing-blocks belonging to this tier. The complete set can then be slid outwards, and a new set inserted without disturbing any other part of the structure. After the crusher is first erected, and all adjustments are made, the distance between the back of the steel bearing-blocks and the outer frame is packed solid with metal pieces cast for the purpose. The crusher throughout is either malleable or cast steel, and the gearing is also of cast steel.

The crushers are in duplicate; one crusher alone being sufficient for the entire work. They are, however, separately geared, and driven from the main source of power; but the feeding-belt is of single type. The crushers discharge into the boot of either one of two 30-inch continuous bucket elevators, rising to a height of 74 feet above the retort-house, in the dormer roof of the house; one alone being sufficient for the entire work. Each elevator can be made to discharge into one of two 30-inch push-plate conveyors running transversely within the retort-house roof, each of which, in turn, is made to feed into one or more of four 24-inch push-plate conveyors—one running centrally over each line of coal-bunkers—and having apertures with sliding doors in the bottom of the trough for the filling of the coal-bunkers. The push-plate conveyor is, in my opinion, the most suitable in this position in a retort-house. It is comparatively slow in travel, and discharges

* See illustration in "JOURNAL" for March 3, p. 539.
† This plate will be published next week.—ED. J.G.L.

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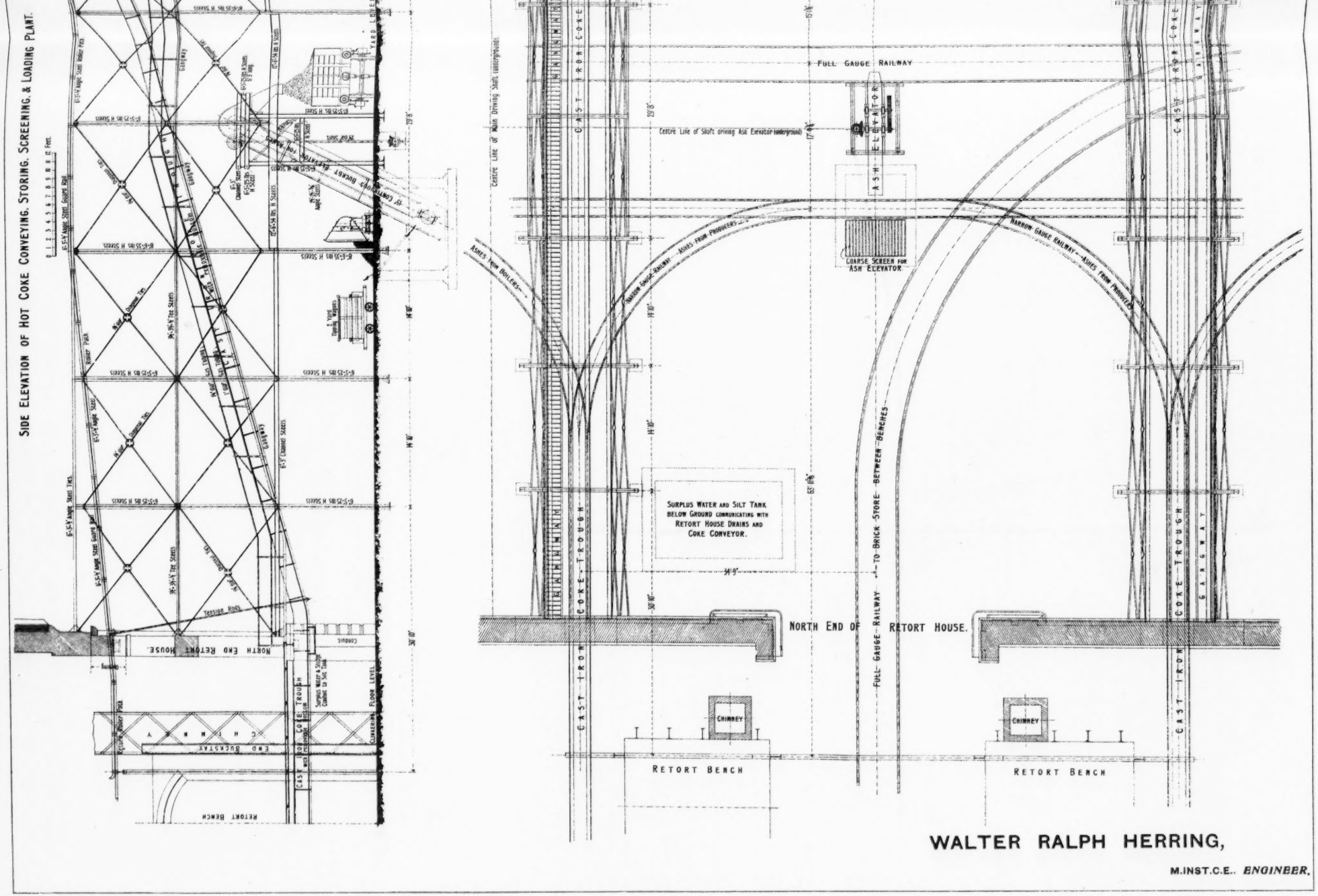
SIDE ELEVATION OF HOT COKE CONVEYING, STORING, SCREENING, & LOADING PLANT.
NORTH END RETORT HOUSE
RETORT BENCH
CHIMNEY
END BUCKSTAY
CAST IRON COKE TROUGH
FULL GAUGE RAILWAY
ASH ELEVATOR
COARSE SCREEN FOR ASH ELEVATOR
NARROW GAUGE RAILWAY - ASHES FROM PRODUCERS
ASHES FROM BOILERS
SURPLUS WATER AND SILT TANK BELOW GROUND COMMUNICATING WITH RETORT HOUSE DRAINS AND COKE CONVEYOR.
TO BRICK STORE BETWEEN BENCHES
NORTH END OF RETORT HOUSE.
GANGWAY
WALTER RALPH HERRING,
M.INST.C.E., ENGINEER.

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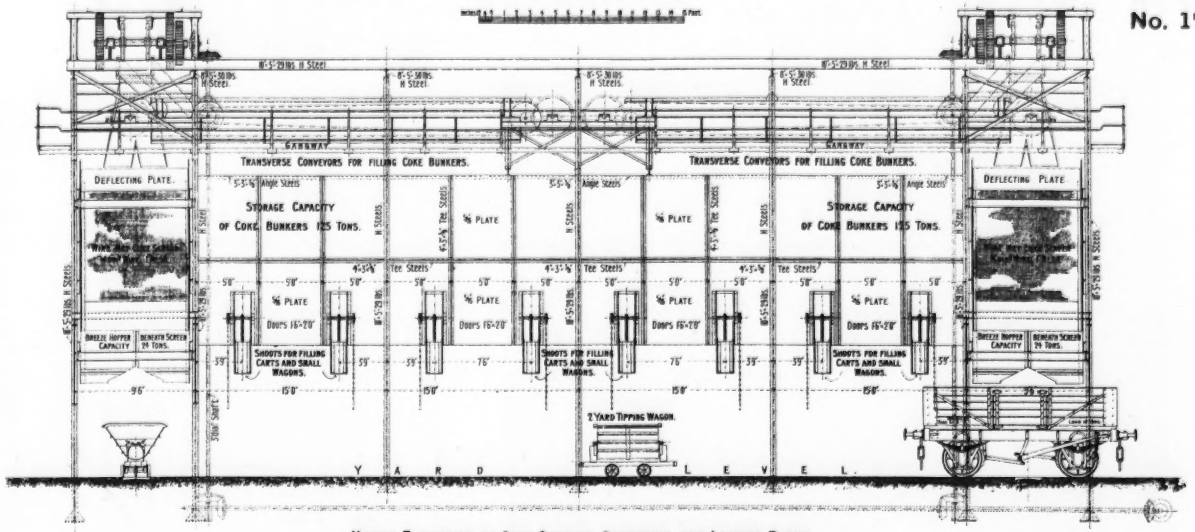
The Granton Works of the Edinburgh and Leith Gas Commissioners.

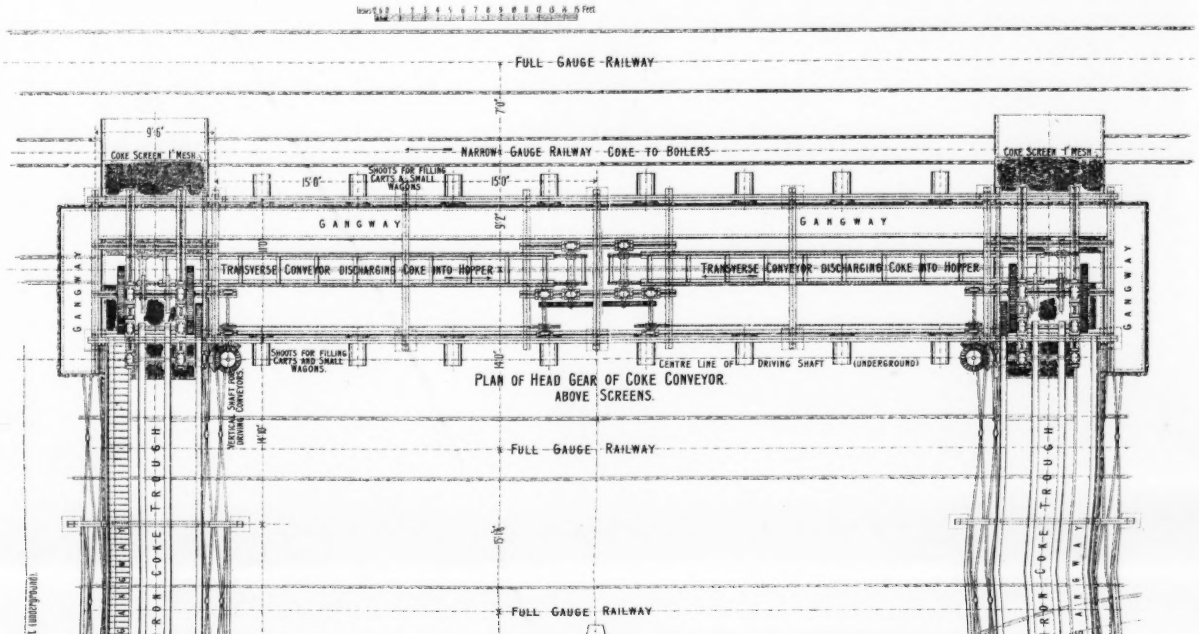
No. 17.

The 1000 Tons per day Carbonizing Plant—Illustrating the General Arrangement of the Coke Plant outside the North End of the Retort-House.

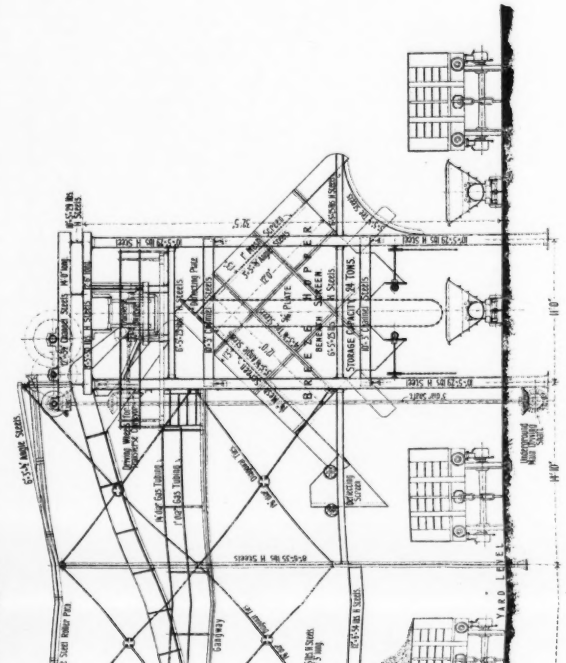

GANGWAYS FOR FILLING COKE BUNKERS.
TRANSVERSE CONVEYORS FOR FILLING COKE BUNKERS.
GANGWAY
DEFLECTING PLATE.
STORAGE CAPACITY OF COKE BUNKERS 125 TONS.
BREEZE HOPPER CAPACITY
BENEATH SCREEN 24 TONS.
SHOOTS FOR FILLING CARTS AND SMALL WAGONS.
2 YARD TIPPING WAGON.
YARD LEVEL

NORTH ELEVATION OF COKE STORING, SCREENING, AND LOADING PLANT.
THIS PLANT IS DRIVEN BY THE SAME SET OF ENGINES ACTUATING THE COAL HANDLING PLANT SITUATED BELOW THE EXHAUSTER HOUSE.

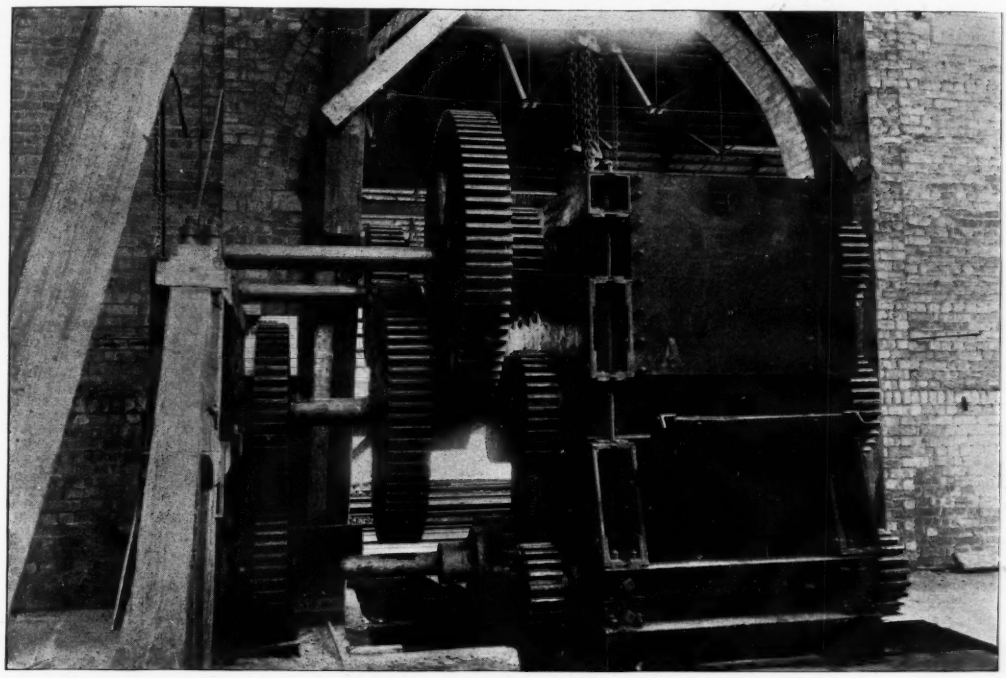
PLAN AND GENERAL ARRANGEMENT OF HOT COKE CONVEYING, STORING, SCREENING AND LOADING PLANT.


FULL GAUGE RAILWAY
NARROW GAUGE RAILWAY COKE TO BOILERS
COKE SCREEN 1" MESH
GANGWAY
TRANSVERSE CONVEYOR DISCHARGING COKE INTO HOPPER
SHOOTS FOR FILLING CARTS & SMALL WAGONS.
CENTRE LINE OF DRIVING SHAFT (UNDERGROUND)
HOT COKE TROUGH

PLAN OF HEAD GEAR OF COKE CONVEYOR ABOVE SCREENS.



LOADING PLANT.

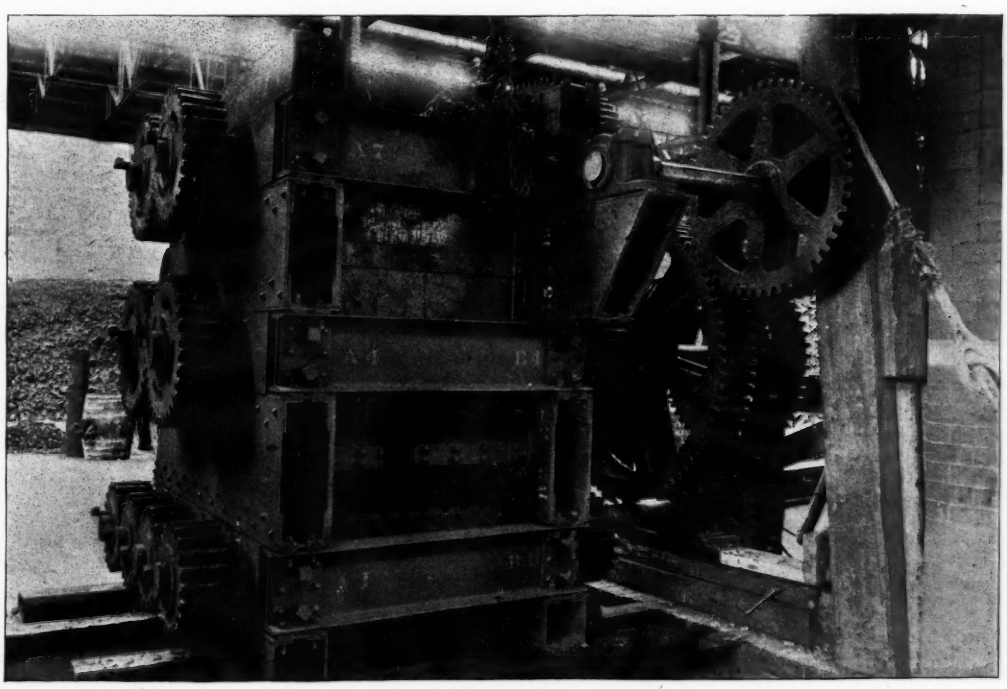


PHOTOGRAPH No. 76.—Front elevation, showing new crusher and gearing.

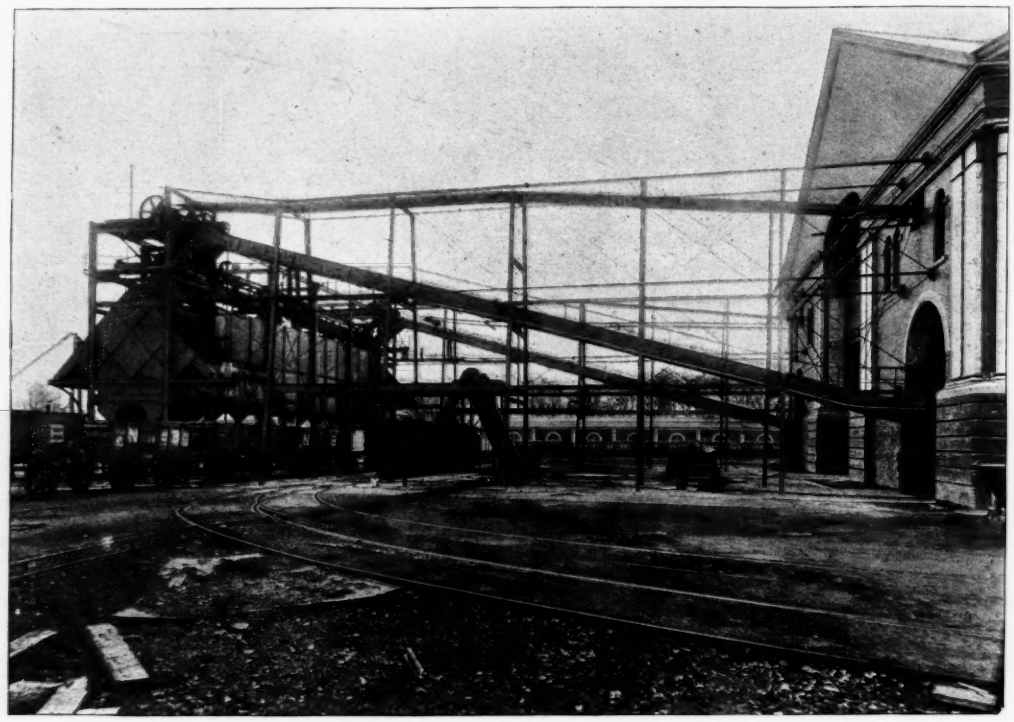
its contents with a minimum of speed and disturbance into the hoppers; the outlet ports on the conveyor being covered by sliding valves, which, however, only need be used when it is particularly required to avoid coal getting into certain hoppers. Ordinarily, as soon as one portion of the hopper is filled up, the push-plate will drag the coal over to the next port. In cases like Edinburgh, where three distinct classes of coal are used, it has been necessary to expend more labour in watching the upper conveyors than is customary, as the continuous hoppers are divided transversely into pockets for the reception of coking coal, splint coal, and cannel coal; the men in charge on the upper gangways watching the delivery of the material elevated, and adjusting their slides so as to fill the particular pockets required. A telephone is also established between the tipping level and the bunker stages, so that information can be sent up of rapid changes in the character of the coal tipped.

At the very outset, I did not determine to introduce a hot-coke conveying plant, although every provision had been made for the introduction of such appliances at a subsequent date. During the progress of the work, however, the development of the hot-coke conveyor had proceeded apace; and I was careful to take the opportunity of watching those then in practical work, among others one installed at one of the stations of the Leeds Corporation Gas-Works by Messrs. Graham, Morton, and Co., the contractors for the carbonizing plant at Granton. This one appeared to me the best suited for the work it was intended to accomplish, and to possess all round advantages as compared with others in use. Principally, the wearing parts were the fewest in number, and these of a character that could be easily renewed from time to time.

The trough of the conveyor (Plate No. 17 and Photographs Nos. 78 and 79) consists of cast-iron plates; the bottom plate being distinct from the side plates, and therefore easily renewable. The bottom, however, is still further protected by a longitudinal strip of flat steel on each side, upon which the chain rollers are made to travel; these strips being renewable season by season as the case requires. The propelling medium for the transportation of coke consists of a double chain, between which



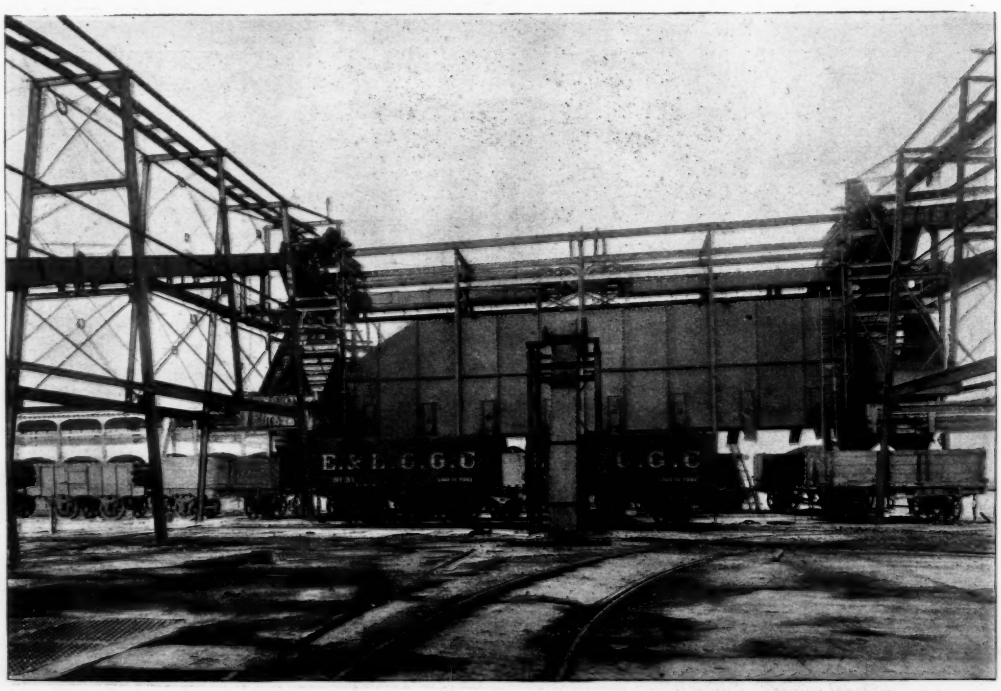
PHOTOGRAPH No. 77.—Side elevation of new crusher and gearing.



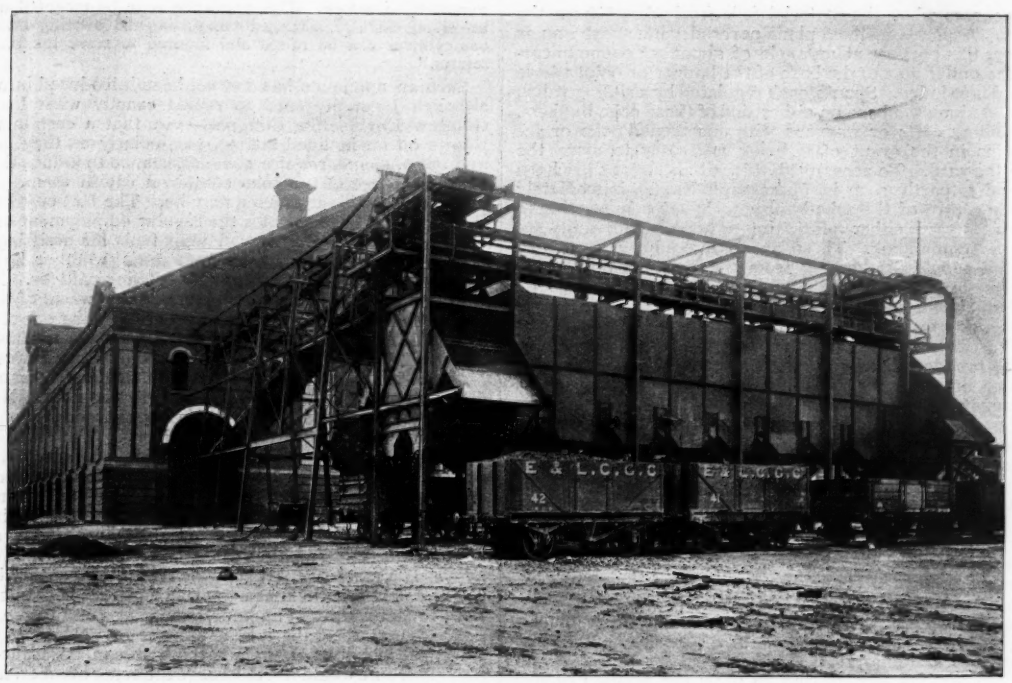
PHOTOGRAPH No. 78.—Coke-trough, screens, and loading arrangements, side elevation, north end of retort-house.

are secured 3 in. by 3 in. by $\frac{3}{8}$ in. angle steels; the chains being placed in the trough 18 inches apart and close to the side plates. The chain is protected from the falling coke by means of cast iron splayed pieces bolted to the sides of the conveyer trough, and these direct the coke into the trough. In this type of conveyor, the coke is drawn along by the propelling cross-bars attached to the chain. I first thought there would be some objection to this, in consequence of the grinding action, not only on the conveyor trough, but also the coke upon itself having a tendency to produce more small stuff. Upon carefully examining this, however, before adopting it at Granton, I found that no such action takes place. The coke is quietly slid along the bottom of the trough without any other movement or disturbance; the water acting as a lubricant. The chain itself is composed of manganese steel, and is of the roller type; the rollers also being of manganese steel revolving on pins distinct and apart from the pins securing the links together. As far as I am able to judge, the only wear and tear on this type of conveyor is on the roller-pins. There is no perceptible difference in the surface of the cast-iron trough, and the pins securing the links are sound after six months' working. Each of the coke-conveyor chains is 975 feet long, and runs continuously night and day, delivering the coke direct over screens for the loading of railway waggons, or into hoppers when the coke is to be stored in the works.

The quenching arrangements on the hot-coke conveyor are of some considerable importance. The dousing of red-hot coke with an excess of water not only spoils its colour, but makes it much more friable than when it is gently sprinkled. I have found that a pipe led transversely across the trough with perforated holes on either side is far more effective than a perforated pipe placed longitudinally on one or both sides of the conveyor.



PHOTOGRAPH No. 79.—Coke-trough and conveyor, storing conveyors, screens, and storage tank; also the ash elevator.

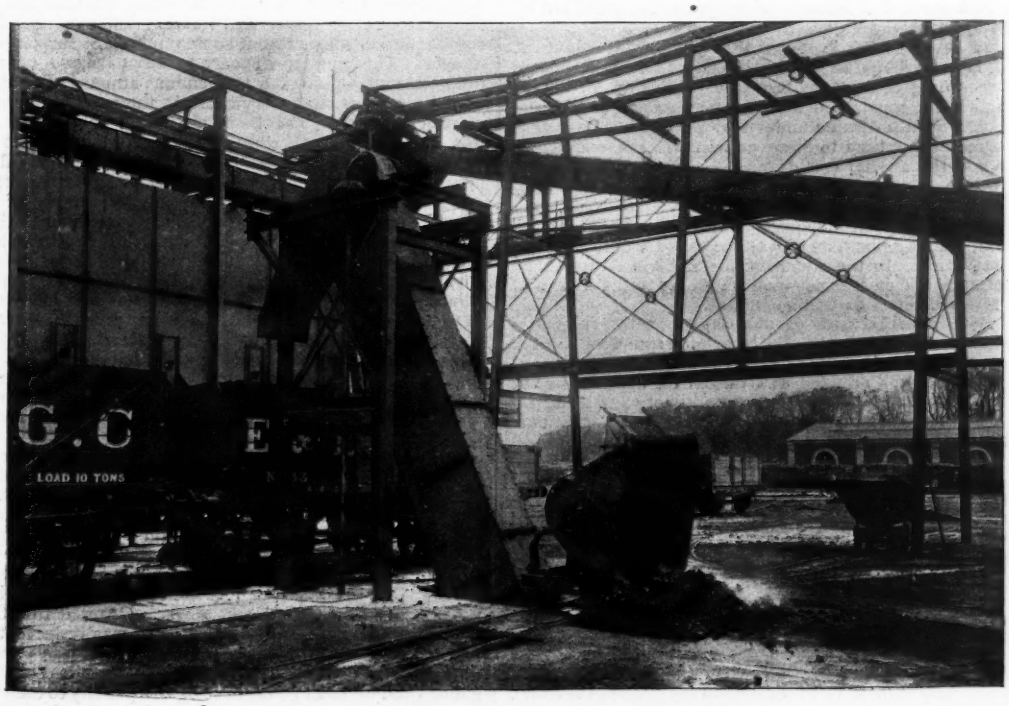


PHOTOGRAPH No. 80.—General arrangement of the coke screening, storing, and loading plant.

Whatever may be done, however, in this respect, is of quite minor importance as compared with the attention devoted to the apparatus by the operatives. The great difficulty is to get just enough water on to the coke to quench it. When the coke is delivered direct into railway waggons, it is imperative that this should be properly done, otherwise in transit the whole waggon is apt to fire again. Rather than leave this operation to the care of the stokers, I have found it better to delegate one man to each coke-conveyor, and hold him responsible for the due and proper quenching of the whole of the coke. The travel of the chain and the coke always in one direction carries all surplus water to the outward end, where it accumulates at the junction between the horizontal and the inclined trough. Provision must be made for drawing away the excess of water at this point by means of a perforated bottom through which the water and also the small dust or silt from the coke will descend. This is conducted into a settling-pit, from which the water is pumped back for the works supply and the silt periodically cleaned out. The gratings covering this pit are seen to the left hand in Photograph No. 79.

The coke-handling plant exterior to the retort-house is shown on Plate No. 17, and Photographs Nos. 78, 79, and 80. Both lines of conveyors, each serving a 500-ton section, are continued outside the retort-house, rising at an angle of 15° where the coke is made to discharge over two pairs of screens—the one side for screening through 1¼-inch mesh, the opposite side for screening through 1-inch mesh; the screenings falling through into a hopper below, from whence they are removed by means of a narrow gauge railway to the boilers and briquette plant, and to the yard. The intervening space between the two side-screens consists of a coke-hopper for holding a night's delivery, in the event of orders being insufficient for the production at the time. Above these hoppers, two longitudinal conveyors are erected of an exactly similar type to the hot-coke conveyor, and from which the coke is discharged into the bunkers beneath.

When coke—or coal for that matter—is allowed to fall from any distance from the base of a conveyor, it is important to provide a bed or trough down which the material may slide, instead of a direct drop upon itself, in order to avoid the breaking which



PHOTOGRAPH No. 81.—Ash elevator and tipping-waggon.

inevitably occurs when the material falls freely direct from the outlet-port. A simple inclined plane covered with sheet iron is sufficient for this purpose at an angle of about 35° communicating from the outlet port to the base of the hopper or point where the material is to lodge. Spouts, each regulated by a sliding-valve, are provided along the base on either side of these coke-bunkers, either for filling carts or waggons with unscreened coke or for loading skips in the event of it being necessary to store the surplus in the yard. To accomplish this, a steam-crane has been erected, and is partly seen in Photograph No. 80, immediately opposite the centre of the coke-bunkers. When commencing to store in a clear yard, either self-tipping or bottom-door skips are slung to the crane-hook. These are brought beneath one or other of the spouts discharging from the coke-bunkers where they are filled; the crane raising these skips and depositing their contents into a conical heap at the extreme reach of the jib of the crane, and to a height as high as the same will stack it—viz., about 25 feet. When this is accomplished, men are sent to the stack to broaden the cone sufficiently to enable a length of a 2-foot gauge light railway to be laid thereon. The trolley of a tipping-waggon is then elevated, and placed upon these rails. The bodies of the tipping-waggons are provided with easy arrangements for slinging to the crane. One of these is brought beneath a spout of the coke-bunkers, and is there filled. It is then raised by the crane, swung round, and lowered upon the trolley on the top of the coke stack, where a man traverses the waggon the length of the rail, and tips it; the empty waggon returning to within reach of the crane, and the operation repeated. As the stack increases, a double line of rails can be laid, so that empties may be returned in one direction, while full waggons are travelling in the opposite direction.

Provision is made for the removal of ashes from the producer-floor, and also from the steam-boilers, by means of a light railway and waggons of a similar type to those used for the coke and breeze. Photographs Nos. 78 and 79 show the position of this ash-elevator, and the ash-waggons; the narrow-gauge railway lines being also exhibited upon Plate No. 17.

Photograph No. 81 shows an ash-waggon in process of tipping. The ash-elevator consists of a continuous bucket elevator—the ash and clinker from the retort-house and boilers being loaded into the tipping-waggons, and, by means of a small locomotive, drawn out and tipped over a coarse screen, through which the bulk of the material falls; the larger clinker alone requiring a knock with a hammer. The elevator loads the ashes into waggons, in which they are removed to the refuse-tip on the foreshore.

The contract for the entire carbonizing plant, including the coal and coke handling, storing, and screening plants, were entrusted to Messrs. Graham, Morton, and Co., of Leeds; and I am happy to be able to say that they have executed the work in a most satisfactory manner, and in a period of time which I believe has beaten all records for such work. While we have not been free from the usual troubles consequent upon putting to work such a mass of machinery—spread over such a large area, and the whole of it actuated from one source—I am glad to say these troubles have been less than one might have reasonably anticipated; and many of our little experiences arose from what certainly appears to have been deliberate mischief on the part of a few misguided men, who felt it to be their duty to their fellow-men to try and prove that labour-saving appliances could not be successfully applied.

In concluding my remarks upon the carbonizing plant at Granton, I may perhaps be allowed to say that an elaborate system of recording the expenditure of every penny for labour and materials in the repair and maintenance and upkeep of the entire plant has been instituted under a system of headings that will enable me at any time to discover what are the most wearable parts, and the annual cost of upkeep and renewal of same. Thus, for instance, take the coke-conveyor. This will be subdivided under the headings of the cast-iron trough, the chain, the chain-pins, the rollers, the roller-pins, and the roller-path; so also with the coal-handling plant, as well as the entire details throughout the installation. In the course of years, it will therefore be easy to ascertain the most exact information as to the wear and tear of an inclined-retort carbonizing plant.

Judging from remarks made in discussions on the subject of inclined retorts in America, and also from correspondence which reaches me from the other side, there appears to be some confusion as to the means adopted at Granton for discharging the coke from the retorts. It has arisen in consequence of a suggestion contained in a paper which I contributed to the International Engineering Congress in Glasgow in 1901. I then said:

"When dealing with the question of the automatic discharge of inclined retorts, by taking certain precautions as to the shape of the cross section of the retort . . . . that the process would be as near automatic as it is possible to have it without introducing additional mechanical devices."

I proceeded to say that—

"This, however, can easily be done, and the author is making preparations for it in the Granton erections by having a hydraulic or compressed-air piston working in and out of the retort from the upper side, arranged with an accelerating motion, so that the piston-head will, upon entering the retort, start very slowly, and gradually increase in speed, descending from 8 to 10 feet into the retort—thus giving the charge the necessary impulse to traverse down the slope of the retort. When once set in motion, there is not much chance of it again coming to a state of repose. This appliance is to be mounted upon a light traversing carriage, arranged with raising and lowering devices, so that one cylinder can be raised and lowered to serve the three rows of retorts."

Such an appliance has not yet been introduced into Granton, although I am prepared to repeat exactly what I said at the Glasgow Engineering Congress—viz., that a certain number of retorts on an inclined setting, particularly as they become old and out of shape, require some assistance to induce the free and easy discharge of the coke contained within them. It matters not how little this assistance may be. The fact of it being sometimes required necessitates the regular employment of a man to be there ready and prepared with tools for assisting the coke from the retorts. It is quite immaterial whether he is working or not. He is there; and his time is being paid for. My suggestion had for its object the avoidance of this waste of time; and I am at the present moment engaged in adapting one of the Arrol-Foulis drawing-machines, for which we have no further use at the New Street works, to accomplish the object I have in view.

It is claimed that, with horizontal machines, a man is able to draw or charge practically sixty retorts per hour. Nobody will deny that an inclined retort can be charged as quickly as a horizontal retort actuated by machinery. The only difference is that the machine charges a 10-foot retort, whereas the inclined retort is 20 feet long; so that twice the amount of coal can be charged with the same exertion on an inclined retort-bench as with a horizontal retort-bench in the same period of time.

Let us now look for a moment at the discharging of the contents of the retorts, taking the figure of sixty charges drawn per hour. If a mechanical rake, which must of necessity be inserted in the retort several times to clear its entire contents, can draw sixty 10-feet retorts in an hour, supposing you reverse the operation, convert the rake into a plunger or push-plate entering a retort 20 feet long, I do not think it can be argued that the same machine would not discharge the same number, if not more, retorts 20 feet long as is now done on the horizontal system. In my opinion, the charge will simply require gently pushing from the top end for a distance of a few feet to induce the entire contents of the retort to flow freely from the mouthpiece. Once put in motion, it is not likely to again assume a state of repose. Stated as a problem, the scheme looks feasible; as a matter of practice, I hope to be able to prove it. There are other important advantages which must not be lost sight of. The delivery and distribution of coal to an inclined retort-house is simpler and less expensive for the same weight delivered than it would be to the two sides of a 20 feet horizontal bench. There is also the question of coke-conveyors—one conveyor serving a 20-foot inclined retort-bench, whereas two must be installed for a horizontal bench, unless my proposed "push-rake" is introduced for horizontal retorts.

ELECTRIC LIGHTING MEMORANDA.

The Finance of Electric Power and Traction—A Warning from Railway History—The Electric Lighting of Poplar.

It is impossible to repel the suspicion which passing events are forcing upon those who watch such matters, that the finance of the great electric power and traction schemes now afoot or in contemplation may present some unpleasant surprises before all is over. The country appears to have become possessed with the notion that there is a tremendous amount of business to be done here, there, and everywhere in the supply of power in the guise of electricity; and there are many people, not novices in this branch of trade, who do not believe it. Time will show where the truth lies in this matter; but it is remarkable that so many purely speculative enterprises of the same order should be undertaken at the same time, for the supply of something which the industrial and travelling world has hitherto gone without, and that in no single case has the hypothesis been put to the proof of experience. It is all very well for eminent persons, some of whom are making a nice little thing out of the fashion while it lasts, to orate at public dinners and on lecture platforms to the effect that, in respect to electric power and traction, this country is on the verge of such an industrial development as it has not experienced since the introduction of railways. This may be true; but the reference has in it as much of warning as of encouragement. Have people who talk like this forgotten the history of George Hudson, the so-called "Railway King," his life and times?

It would, of course, be waste of time to try to precisely discriminate as to the part taken by railways in the making of the United Kingdom as the present generation knows it. But that which has just passed away preserved lively memories of the perilous past through which British railways struggled before the existing systems were brought to their actual shape. A fierce blast of ruin and disappointment passed over the land sixty years or so ago, as the result of just such a "boom" in railways, as is being worked up for electric power. Granted that there was a very great deal of good in railways, it was reduced to a minute fraction of the vast bulk of speculation that was piled upon the idea. We are to this day paying for a good deal of this extravagance; and we shall go on bearing the penalty to the end of time, humanly speaking. The incubus of the Southern Railways of

England will remain a monument to the jobbery of that period. The railway engineering of the United Kingdom was a scramble; and the scramble is being repeated to-day in regard to the various "tube" schemes for London. Millions will be wasted in this way, and it will be fortunate if, in the event, some of the unfittest of the schemes do not survive. The foregoing remarks apply particularly to new electric railways, which appear to be for the present Metropolitan products. Money is also to be lavished upon the electrization of the purely Metropolitan railways. It is to be hoped that those who provide the funds will find it worth their while in the long run. Like electric lighting undertakings, there is no limit to the capital account. The Metropolitan District Railway Company were to have spent £400,000 upon a power-house, which is now estimated to cost £1,200,000. Of course, this has to be "financed;" and other Railway Companies are to be served by it as well as the District. The conversion of the line is also going to cost much more than was originally believed. It now appears that this undertaking wants £1,400,000 for this work —more "finance"! It is marvellous how the money is to be raised on the credit of a concern whose capital stock is only quoted at about one-third of its nominal value.

The condition and prospects of the municipal electric lighting undertakings in the East of London are beginning to seriously concern the local authorities and the ratepayers. Matters are not improved by the delay shown in the issue of what pass for the accounts relating to these ventures. The electric lighting accounts of the borough of Poplar for the year ending March 31, 1902, are only just out; and they appear in the form of the barest abstract that would pass the Government audit. There is no explanation of a delay in publication which robs the figures of much of their value to the ratepayers. This staleness of the accounts, coupled with the deferment of the commencement of the repayment of the later and larger loans, renders it impossible for the ratepayers to discover the real state of affairs. Meanwhile the suspicion has arisen, and is acknowledged in a local newspaper, that this particular example of municipal enterprise is only kept going by continual expenditure on capital account. It is further complained that the cost of the road-mending for the department is charged to the Works Committee. For the repair and maintenance of machinery standing the ratepayers in £42,000, the handsome allowance of £10 appears in the revenue account! The whole of the capital expenditure on the undertaking has been £150,000; and there does not appear to be the faintest prospect of its ever paying for itself.

THE LIMITS OF COMBUSTION IN GASEOUS MIXTURES.

As briefly mentioned in the "JOURNAL" for the 24th of February (p. 481), MM. L. Pelet and P. Jomini have conducted a series of experiments on combustion in atmospheres of different compositions, designed to elucidate the phenomenon of flame extinction in the presence of incombustible gases. The flames selected for this investigation were those of a candle, a lamp burning alcohol, and ordinary illuminating gas (flat-flame burner). Beginning with a bell-jar containing air charged with increasing proportions of carbonic acid, and proceeding with atmospheres artificially prepared with various mixtures of carbonic acid, oxygen, and nitrogen in known proportions, the following results were obtained from flames of coal gas. The combustion was always operated in a bell-jar containing 12 litres:—

Air Charged with CO_2. Per Cent.	Duration of Combustion. Seconds.	Percentage Composition of Atmosphere after Extinction. CO_2.	O.	N.
8·0 ..	40 ..	10·4	11·0	78·6
11·0 ..	20 ..	12·0	11·0	77·0
13·0 ..	10 ..	13·0	11·3	75·7
25·0 ..	0 ..	25·0	12·5	61·5

Result of combustion of the same gas in a mixture of oxygen, nitrogen, and carbonic acid:—

Composition of Atmosphere before Combustion. Per Cent. CO_2.	O.	N.	Duration of Combustion. Seconds.	Composition of Atmosphere after Extinction. Per Cent. CO_2.	O.	N.
0	40	60 ..	40 ..	13·0	10·9	75·2
0	50	50 ..	42 ..	12·5	11·2	75·5
0	55	45 ..	50 ..	14·8	10·7	74·5
0	60	40 ..	50 ..	14·8	11·2	74·5
24	40	36 ..	50 ..	34·4	11·2	54·4

It appears from this that a gas-flame is able to maintain itself in the presence of very variable quantities of carbonic acid, so long as there remains a certain proportion of unconsumed oxygen in the gaseous mixture. The flame went out when the proportion of oxygen in the atmosphere became lowered to 10·7 or 12·5 per cent. The changes of the flame before extinction give interesting data as to the modifications of the combustion. As a rule, the flames grow longer before dying out, smoking. When the combustion is taking place in the presence of a certain proportion of carbonic acid, the hydrogen of the combustible alone burns, forming water, and the proportion of carbonic acid formed increases scarcely at all. This fact is especially characteristic of the results of the experiment with illuminating gas burnt in air charged with different proportions of carbonic acid, where in the last experiment but one the quantity of this gas present was the same before and after the combustion. In the last experiment given, the increase of carbonic acid is only apparent. It is due exclusively to the disappearance of 30 per cent. of oxygen, converted into water vapour not estimated. The combustion in this case was entirely at the expense of the hydrogen. With different kinds of combustibles, the proportional reduction of oxygen at which the flame will continue to burn is relative to their inflammability, which is roughly as the flame temperature. Thus candle flames will go out while the atmosphere still contains from 16 to 17 per cent. of oxygen; the alcohol flame requires at least 14·3 to 15·4 per cent. of uncombined oxygen; whereas illuminating gas, as already shown, will burn when the oxygen is as low as 11 per cent., or even a fraction under.

A point of practical importance that suggests itself in regard to these results is, that an atmosphere too heavily laden with carbonic acid to support human life—that is to say, with a reduced oxygen content—may be made capable of doing so by the simple addition of oxygen. It will not be necessary to perform the more tedious operation of removing the carbonic acid. It would also appear that in certain cases of asphyxiation, the cause of death should be sought in a lack of oxygen, rather than in the presence of an excess of carbonic acid. Moreover, it is evident that a flame of coal gas may still burn, although in a languid and smoky manner, where human life could scarcely be sustained. This observation does not apply to the flame of a candle, which seems to require as much oxygen as animal life.

PERSONAL.

We learn that Mr. ISAAC WILKINSON, jun., will succeed his father as Manager of the West Auckland Gas Company.

Mr. E. HAMSON, Distribution Superintendent to the Nuneaton Gas Company, has been appointed Assistant-Manager to the Swindon United Gas Company.

Those of our readers who have had business relations with the Economical Gas Apparatus Construction Company, Limited, will doubtless remember Mr. A. I. PAYNE, who for some years was one of the Company's Constructing Engineers. On Saturday, the 18th inst., Mr. Payne sailed for New York, on his way to British Columbia, in order to take over the management of the Nelson Gas Company, of which the Directors of the above-named Company are the principal owners. Mr. Payne is a graduate of Princeton University; and he was one of Mr. Westcott's able assistants.

OBITUARY.

St. Andrews has just lost by death one of its most popular men in the person of Mr. RITCHIE WELCH. He was the Provost of the city, and Chairman of the Gas Company.

Sir THOMAS THORNTON, Town Clerk of Dundee, died at his residence in that town last Tuesday morning, from an affection of the heart which seized him in the street on the afternoon of the previous day. He was in his 73rd year. Among the first of the many public offices he filled was that of Clerk to the Dundee Gas Commission, to which he was appointed in 1868, when the transfer of the gas-works took place. As a matter of fact, he was one of the promoters of the transfer, as he was of the transfer of the water undertaking three years later. In 1891, he received the degree of LL.D. from the University of St. Andrews.

The "Vivid" Mantle.—Since the settlement of the action for infringement which the Welsbach Company commenced against the Vivid Incandescent Mantle Company, in which settlement there was a mutual recognition of the validity of the respective patents, the Vivid Company have been making considerable movements which have brought the manufacture of the mantle under direct control, and have greatly extended the Company's business operations abroad. The mantle, as has before been stated in the "JOURNAL," is of German origin; and in order that the production of the mantle may be continued under the eye of the inventor and responsible chemists, the factory, in which provision has been made for a greatly extended output, remains in Berlin. In addition to the cotton fabric, the mantle is now being made with a silk base to meet the requirements of customers; and we are informed that, by the special treatment this silk mantle undergoes, once it is burnt off, it does not shrink in use, but it is necessary to exercise care in the burning off. This, like the cotton mantle, is made of very close mesh; the contention of the makers being that, the closer the mesh, the greater must be the amount of fluid absorbed, and consequently the larger the incandescing surface. Those under whose supervision the manufacture is conducted insist on the greatest exactitude being observed, even to the weighing of each mantle, and the rejection of any that are under a given weight. Among other points of interest on which information has been communicated are these —that an injunction against the sale of the mantle has been refused in Australia, and that Herr Rund, who recently figured prominently in the Welsbach case in the Austrian Courts, has been appointed to represent the Vivid Company in Austria.

COMMUNICATED ARTICLES.

GAS MAKING WITH CRUDE OIL IN CALIFORNIA.

In a recent issue of the "Petroleum Review," an article appeared on the above subject which awakened considerable interest. This led to a communication being addressed to the special correspondent of that paper at San Francisco, with the result that some valuable information was supplied as to the use of crude oil in various gas-works in California. Considering that the particulars furnished may be of some use to our readers, they have been forwarded by Dr. Dvorkovitz for publication in the "JOURNAL;" and we are pleased to give them insertion.

Up till lately, the type of apparatus used in California has been the standard water-gas apparatus. When the necessity for utilizing the heavy California oils became apparent, a great number of standard Lowe double-superheater plants were already in use, and our experiments had to be in the line of using this apparatus for oil gas purposes. The Lowe apparatus consists of generator, carburettor, and superheater; the generator being fitted with grates for fuel, and the carburettor and superheater filled with checker brick. It has been decided to discard the generator, as it is intended to use only liquid fuel—no hard fuel at all—and it has been found that for breaking up the oil and fixing the gas the carburettor and superheater are quite sufficient. A special oil-burner was placed on the top of the carburettor, with air connection, as in the water-gas machine. The connections between the machines were enlarged, as were also those to the seal and the stack-valve. While one seal is all that is required for water gas, we found that a great deal of lampblack would pass this seal, making a secondary seal necessary in the bottom of the scrubber. The overflows from these seals were made extra large, so as to carry off the lampblack, which seems to be one of the difficulties we have to contend with. In this apparatus, the direction of the blast and run is similar, being from the top of the carburettor down the shell, up through the superheater, and out either through the stack-valve or the connection to the seal.

One type of apparatus which came on the market reversed the run. It consisted of an upright shell with a projection at the bottom. The entire shell, with the exception of the lower projection, was filled with checker brick. The blast and the oil-burner for heating the bricks were placed at the side of the projection; the blast being upward through the shell and out at the stack-valve on top. The oil and steam for the run were placed at the top of the shell, and the outlet to the seal on the top of the projection at the bottom; the run being in the opposite direction from the blast, and the gas passing down the shell and out from the top of the projection into the seal. The objection to this type of apparatus was that in blowing or heating it up the oil-burner at the top of the shell would clog up, giving a great deal of trouble. The oil-burner behind, at the side of the projection, would spray the oil upon the opposite wall, and rapidly burn out the lining or become disintegrated through the action of the oil upon the bricks, necessitating the relining of this part of the apparatus at frequent intervals. This, of course, could only be done by shutting down the machine for several days, compelling the gas companies to have at least two sets of plant.

In the case of the two-shell or water-gas design of apparatus, the oil is injected through the top of the carburettor upon the loose checker brick, with, of course, the same result, as far as the crumbling of the bricks is concerned; but as the shell is provided with doors at different points along its height, it is only a small job to open the upper door, and pull out a few of the bricks that show signs of breaking up. The lower heats carried in this apparatus, because of the greater length of the two shells affording longer contact of the gas with the heated bricks, are important factors not only in the life of the checker bricks, but also in the amount of lampblack made. The linings in the two-shell apparatus are not affected, for the reason that no direct heat ever comes in contact with them.

With continuous working of the plant, much better results are obtained than where the operation is intermittent, for the reason that more oil is required to bring the apparatus from a cold, or partially cold, condition to that of gas making, than to bring it to this condition between runs. At Watsonville (Cal.), where only about 25,000 cubic feet of gas are made each day on a machine of 100,000 cubic feet daily capacity, 75 lbs. of fuel oil per 1000 cubic feet of gas manufactured are used. At San Jose, where the full yield of a 200,000 cubic feet capacity machine is required, 70 lbs. of fuel oil per 1000 cubic feet, on an average, are required. This includes all fuel used under the boilers. This boiler fuel consists largely of lampblack coming from the apparatus during the run or gas-making period. In the San Jose plant, no other boiler fuel is used—enough accumulating from the machine to supply the boilers. But the smaller plant requires some oil in addition to the lampblack made during the run, principally because much more boiler fuel is used proportionally on a short run than where the run is continuous. As already stated, from 70 to 75 lbs. of the fuel are required per 1000 cubic feet of gas manufactured. Of this, about 25 lbs. are for heating the apparatus, and 45 to 50 lbs. for the gas made.

The calorific value of the gas obtained is not so great as that of coal gas, but it will be best understood by a perusal of the following analysis made from gas taken at two different works:—

	Works A.		Works B.
Carbon dioxide	3·2	..	0·2
Ethylene	8·6	..	5·3
Oxygen	0·0	..	0·2
Carbon monoxide	7·0	..	4·0
Hydrogen	52·0	..	57·2
Marsh gas	23·4	..	29·0
Nitrogen	5·8	..	4·1
	100·0	..	100·0

The difference in the two gases was largely on account of the candle power; the first sample being 26-candle, and the second only 21½-candle gas. As figured out, the first sample contains 616 B.T.U. per cubic foot, and the second 575·17 B.T.U. The first sample was of gas made to displace coal gas, while the other was used instead of water gas. Both are very satisfactory in their place; no readjustment being necessary in stoves, burners, or Welsbach lights.

At Orville (Cal.), one of the gas-producers referred to has been in operation for about sixteen months, supplying the city with gas; no other form or type of apparatus being used at these works. At San Jose, the oil-gas works have been in operation for about three months, and are supplying the entire output; the coal and water gas apparatus being all shut down. At Watsonville, they have been making exclusively oil gas only about a month; while a number of works are under construction.

Gas made from fuel oil has been demonstrated to be a success on the Californian coast; and while the larger gas companies are conservative in adopting the apparatus designed for oil gas, they must, it is thought, eventually make the change. Small companies sending out from 20,000 to 30,000 cubic feet daily can, under present conditions, make and furnish gas to the consumers for much less than the companies in San Francisco, sending out 5 millions per day, and making coal or water gas. This is a condition of affairs that cannot remain for any length of time.

FANS IN GAS-WORKS.

By R. GORDON MACKAY, Assoc.M.Inst.C.E., Member of the Berlin Section of the Society of German Engineers.

PART IV.—BOILER DRAUGHT.

(*Continued from p.* 148.)

1. FOR FORCED DRAUGHT FAN SYSTEM.

$$Q = 236 \times \frac{1120}{3600} = 73{\cdot}5 \text{ cubic feet per second.}$$

The total back-pressure here is the resistance to motion offered by the fuel, by the piping, and by the fan housing, which, when the fan inlets are free and large, may be taken here as equal to 2½ inches of water. Then from the formula (7) when

$$h = 2\tfrac{1}{2} \text{ in. and } t = 60°. \text{ Fahr.}$$

$$a = 0{\cdot}65\sqrt{\frac{Q}{2\,gh\,\frac{\gamma_0}{\gamma}\,\frac{459+t}{459+32}\,\frac{1}{12}}} = 1{,}075 \text{ sq. feet.}$$

So that the diameter of each of the two inlets should be 18 inches, and the proportion of the fan wheel may be: Two inlets, 18 inches diameter, or one inlet 25 inches diameter; and the diameter of the fan-wheel must be built according to circumstances—viz., whether electric or steam driven.

The required circumferential speed is found from formula (3) where

$$H = k\,\frac{u^2}{g}\,\frac{\gamma}{\gamma_0}\,\frac{459+32}{459+t}\,12$$

where

$$k = 0{\cdot}80 \text{ for radial vanes}$$

and from formula (4)

$$H = \frac{h}{0{\cdot}91} = 2{\cdot}75 \text{ inches,}$$

So that since

$$2{\cdot}75 = 0{\cdot}80\,u^2\,\frac{12}{g}\,0{\cdot}001225$$

$$u = 86{\cdot}5 \text{ feet per second.}$$

The power taken by the fan, assuming 65 per cent. efficiency, would be

$$\frac{73{\cdot}5 \times 2{\cdot}75 \times 5{\cdot}2}{550 \times 0{\cdot}65} = 2{\cdot}9\text{-horse power}$$

and, allowing 45 lbs. of steam per horse power hour, 130 lbs. of steam per hour are required, or

$$\frac{130}{9000} \times 100 = 1{\cdot}45 \text{ per cent. of the steam generated}$$

by the boiler.

2.—For a Suction-Draught Fan System.

It is very difficult here to select a good example for demonstrating the application of a suction-draught plant. A case comes before the writer's mind in which a boiler plant had been extended, and the chimney was found to be not large enough to answer the increased consumption of fuel. It was, therefore, either necessary to build another chimney, or apply a suction-draught fan to the existing chimney as a bye-pass. Already the violent blowing of cold air under the ash-pit had been tried, and the furnace was literally under air pressure, causing the suddenly expanded cold air to return through the furnace-doors, because the chimney was totally inadequate to pass such a quantity of gas away—partly owing to badly built flues, having sharp instead of round corners. To apply a suction-draught fan in such a case was only to suck away the heat of the boiler and to still further reduce the efficiency of the plant (the temperature in the chimney, as measured by a pyrometer, was already 600° Fahr.). In such a case, the through passage of the fan, in the writer's opinion, should be, at the least, equal to the cross-section of the chimney, and the fan must meet a very strong suction, to overcome the resistances, and at the same time draw such a volume of gas expanded to a temperature of 600° Fahr. There was a case in which using over again a portion of the gas would have relieved the chimney, have heated the cold air supply, and unburnt carbon and carbon monoxide would have found their way again into the furnace, with a consequent reduction of smoke, and increase of efficiency. A suction-draught fan was tried, but took too much power, and drew too much heat off; and after three weeks the experiment was closed.

But where there are economizers or air-heaters reducing the temperature of the gases from 600° to 300° Fahr., and offering too much resistance for a chimney, then a suction-draught plant is interesting, and at times successful in its application. The wheel must be of large diameter when it is directly connected to a steam-engine, owing to the speed of the latter, and it must be carefully made on account of expansion. In this case,

$$Q = 350 \times \frac{1120}{3600} = 109 \text{ cubic feet per second,}$$

and assuming the resistances as $2\frac{1}{2}$ inches water gauge, the value of a becomes, from formula (7), 1·6 square feet, and an inlet of 30 inches diameter might be recommended—its cross-section being rather more than three times the value of a. Theoretically, the outlet here should be larger, because the fan is an exhauster, and is really only required to suck the gases away. The power absorbed may be taken as varying as the volumes or absolute temperatures here, and not as the squares (see Part I), because a larger fan is to be recommended in order to reduce the working depression of one wheel. So 4·3-horse power may be taken as approximately correct; or, assuming 45 lbs. of steam per horse-power per hour for the small quick-running steam-engine, then 2·15 per cent. of the steam generated by the boiler is used for creating draught. The first cost is not high, because there are practically no iron ducts to build, and it is nobody's patent; but makers will not offer guarantees for smoke prevention or economy in fuel consumption very willingly.

In concluding this short section on draught, one can only hope that, in spite of the years already given to the study of the betterment of boiler plants, and their now possible efficiency of 70 to 75 per cent. under running conditions, the specialist will not be stinting in his efforts, and that soon short smokeless chimneys, quite independent of natural conditions, will be the rule and not the exception.

The St. Louis International Exhibition.—His Majesty the King has been pleased to appoint a Commission in connection with the International Exhibition to be held in St. Louis next year, to which reference has already been made in the "Journal." The names of the members of the Commission (the President of which is His Royal Highness the Prince of Wales) were published in the "London Gazette" last Friday; and among them are the following which are familiar to our readers: Mr. Charles Vernon Boys, F.R.S., one of the Metropolitan Gas Referees; Mr. J. C. Hawkshaw, President of the Institution of Civil Engineers; Sir George Livesey; Mr. W. H. Maw, Past-President of the Institution of Mechanical Engineers; Sir W. H. Preece, Chairman of the Society of Arts; Mr. Boverton Redwood; and Mr. J. W. Swan, F.R.S.

British Association of Water-Works Engineers.—We have received from Messrs. Biggs and Co. the "Transactions" of the Association for the past year. The volume consists of the papers read at the seventh annual general meeting, held at Leicester in July, under the presidency of Mr. Frederick Griffith, M.Inst.C.E., the Water Engineer to the Corporation, and at the winter meeting, held in London in December, with the discussions thereon. As the Association have taken so prominent a part in connection with the preservation of underground water supplies, a report of the proceedings at the interview with the President of the Local Government Board in October is included. The technical matter is illustrated by a number of folding plates. The useful subject-matter index has been brought up to date, and the volume produced under the editorship of the Secretary, Mr. Percy Griffith, M.Inst.C.E., F.G.S.

TECHNICAL RECORD.

EASTERN COUNTIES GAS MANAGERS' ASSOCIATION.

The Twenty-ninth General Meeting of the Association was held at King's Lynn last Wednesday; and a long but highly interesting programme was successfully carried through under the presidency of Mr. E. W. Smith (Chelmsford). Mr. E. G. Smithard, the Engineer of the King's Lynn Gas Company, found a congenial task in making the preparations for the reception of the members; and he was loyally and royally aided by his Chairman (Mr. T. E. Bagge) and Directors, whose influence placed at the disposal of the Association the many conveniences of the ancient Town Hall for the meeting. It was there that the visitors first met with a most hearty welcome by Mr. Bagge and his colleagues, who entertained them to a luncheon which was served with that traditional generosity which distinguishes such old provincial towns. Before leaving the table, the Chairman and Directors were cordially thanked by the members, after happy little speeches by the President and the Vice-President (Mr. J. H. Troughton). Subsequently, too, on the motion of Mr. J. Carter (Lincoln), the indebtedness of the members to the Mayor and Corporation, and their wish for the prosperity of the borough, were heartily acknowledged and expressed. His Worship (Mr. F. J. Carpenter) made a suitable response.

The Meeting was afterwards held in the Council Chamber; and, on the President taking the chair, the Hon. Secretary (Mr. T. A. Guyatt, of Ely) at once read the minutes of the meeting held at Chelmsford last autumn, and they were confirmed.

Report and Accounts.

On the motion of Mr. H. Wimhurst (Sleaford), seconded by Mr. J. Barton (Peterborough), the Committee's annual report and the accounts were adopted. The former first reviewed the proceedings of the year, and ended as follows: "The year commenced with a membership of 85. The Committee regret to report that four deaths have occured during the year; and one member severed his connection under Rule 19. Seven new members were elected; making the total at the end of the year 87. The accounts show that a balance of £51 3s. 7d. was brought forward, and the subscriptions paid during the year amounted to £43 11s. 6d.; making a total of £94 15s. 1d. The expenditure was £56 19s. 7d., which leaves a balance in hand of £37 15s. 6d., and a few subscriptions outstanding. The Committee are pleased to report that the testimonial to Mr. Troughton was well supported; the amount collected being sufficient to purchase a silver tea and coffee service, and a gold bracelet for Mrs. Troughton. The attendance at the meetings during the year has been encouraging; but the number of papers volunteered still leaves much to be desired. The Committee again desire to call attention to this matter, which is a very important one if the usefulness of the Association is to be maintained, and to urge upon the younger members the necessity of bringing forward papers for discussion."

On the motion of the President, seconded by Mr. Barton, the following additions were made to the roll of members: Mr. J. W. Auchterlonie, of Cambridge; Mr. H. Duesbury, of Hertford; Mr. W. B. Palmer, of Harwich; Mr. S. Smithard, of Broxbourne; and Mr. C. Green, of Market Rasen.

Papers and Discussions.

The greater part of the afternoon was then occupied by the reading and discussion of the following papers: By Mr. E. G. Smithard on "Sewerage Excavations and Unaccounted-for Gas;" by Mr. E. J. Brockway, on "Blue Water Gas, and Its Enrichment by the Peebles Oil Gas Process;" and by Mr. H. Wimhurst on "Facilitating the Collection and Counting of Coin from Prepayment Meters." These papers, with a report of the discussions, appear elsewhere in the present issue.

At the close of the discussion on the last paper,

The President said it was usual after the reading of papers—and the members would be especially glad to do it on this occasion—to pass a vote of thanks to the authors. He had much pleasure in moving such a vote to Messrs. Smithard, Brockway, and Wimhurst for their excellent contributions.

Mr. Arthur Graham (Mansfield) seconded the motion, which was heartily agreed to.

Mr. Smithard, on behalf of himself and the other authors, briefly responded.

Election of Office-Bearers.

Mr. J. Barton (Peterborough) proposed the election of Mr. Troughton as President for the ensuing year. He remarked that all the members knew quite well what a useful member and

official Mr. Troughton had been to the Association; and he (Mr. Barton) hoped and believed his election would be unanimous. He had no doubt Mr. Troughton would be as useful in the presidential chair as he had been in carrying out the duties of Hon.-Secretary to the Association.

Mr. C. F. Ruggles (Leighton Buzzard) seconded the proposition, which was unanimously agreed to.

Mr. Troughton, in response, said he was exceedingly obliged to the members for this fresh mark of their regard, in electing him to be their President. It was an honour he had been induced to accept, with some reluctance. But his friends said he must go through the chair; and so he would do his best.

Mr. H. Wimhurst (Sleaford) said he had to propose for the vice-presidency a gentleman who was very much connected with the gas industry. Not only was he so himself, but his family were too. He believed there were four brothers, their father, and two uncles who were gas engineers; and if this was not a record, he did not know what was. The gentleman he had to propose was a neighbour of his own, and a very worthy fellow. The members would remember their visit to Boston twelve months since, and the grand reception they had there; and now he had to propose for their acceptance the election to the vice-presidency of the Gas Engineer of Boston—Mr. J. S. Dougall.

Mr. C. G. Grimwood (Sudbury) seconded the proposition, and it was cordially adopted.

Mr. Dougall sincerely thanked the members for the honour conferred upon him. He could only re-echo the remarks of Mr. Troughton, and promise to do his very best to fill the position—he hoped, to the satisfaction of the members.

On the motion of Mr. J. Carter (Lincoln), seconded by Mr. Smithard, Messrs. G. R. Casterton, C. G. Grimwood, and F. Smallbone were appointed members of the Committee; the last named gentleman serving for one year in place of Mr. Dougall, owing to his election to the vice-presidency.

The next resolution—moved by Mr. Wimhurst and seconded by Mr. J. Beck (Stamford)—appointed Messrs. C. Panchen and J. Witten to the auditorship.

Place of Next Meeting.

On the invitation of Mr. Troughton, the members decided to hold the autumn meeting at Newmarket.

The usual votes of thanks terminated the business proceedings.

The King's Lynn Gas-Works.

During the visit, those members who had the opportunity inspected the gas-works. It was seen that the carbonizing plant consists of six settings of eight retorts, each 22 in. by 16 in. by 9 ft. 8 in. long, with Holman's patent mouthpieces and lids, and interchangeable bar-lock fastenings. The settings are on Hislop's patent shallow regenerative principle. The chimney shaft is 80 feet high. The ascension-pipes are 7 in. to 6 in.; and the bridge-pipes 6 inch, fitted with self-sealing cleaning caps, lever, and screw. The dips are 6-inch; and the hydraulic mains are arranged one for each three beds, in continuous lengths, and fitted with tar and liquor seal valve and flushing device. A 12-inch foul main runs round the retort-house for about 600 feet. The condensers are six-tube annular ones. There are two boilers—one a Galloway, 12 ft. by 6 ft. 6 in., with two fire-boxes, and a Cornish, 12 ft. by 4 ft. 6 in. There are also two combined engines and exhausters—one a three-blade Waller, with a capacity of 30,000 cubic feet per hour, and the other a Gwynne of 15,000 cubic feet per hour, controlled respectively by Waller's and Donkin's hydraulic regulators, without bye-pass. The scrubbing and washing are performed by one of Walker's purifying-machines and tar-extractors, with a capacity of 500,000 cubic feet a day, and a Kirkham, Hulett, and Chandler "Standard" washer, with a capacity of 350,000 cubic feet. Mr. Smithard is the possessor of four purifying-boxes (25 ft. by 20 ft.) on the stage-floor, with shoots for emptying, and an elevator (driven by a Crossley gas-engine) for lifting the oxide. He has also four 12 feet square catch boxes—three charged with lime, and finishing with one oxide. The station meter is of Milne's make, cylindrical, and of 20,000 cubic feet per hour capacity. There are three gasholders—the largest being a two-lift one, 90 ft. by 50 ft., with Cutler's patent guide-framing; the second, two-lift, 70 ft. by 40 ft., with lattice framing; and the third, a single-lift, 70 ft. by 20 ft., with cast-iron columns and girders. The station governor is a 15-inch Braddock, with water-loading arrangement. A boiler-tube type carburettor is in use. The plant also comprises a set of three-throw pumps, to pump water from the river, for circulating liquor, and for the boiler feed. A Sherwin coke-breaker, driven by a gas-engine, is also employed.

In the evening the members and friends dined at the Globe Hotel; and thus pleasantly ended a day which had been fully occupied in carrying out the complete programme arranged by the Committee, with the assistance of Mr. Smithard.

Mr. Louis Penny has been selected to fill the vacancy on the Board of the Bombay Gas Company, Limited (of which he was for many years Manager, and lately Auditor), caused by the death of Mr. Charles Gandon.

NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION.

Half-Yearly Meeting in Newcastle.

The Half-Yearly Meeting of the above-named Association was held in the County Hotel, Newcastle, on Saturday. There was a very good attendance. Mr. A. B. Walker, of Walker-on-Tyne, the President, occupied the chair.

The Accounts.

The President opened the proceedings by moving the adoption of the accounts; remarking that, though a change had been made in the statement of them, the Association was really in as good a position financially as at this time last year.

Mr. F. P. Tarratt (Darlington) seconded the motion; and it was agreed to.

New Members.

Mr. W. T. Lancaster, of Ripon, was elected a member of the Association, Mr. R. W. Nicholls, Assistant at the Darlington Gas-Works, an associate; and Mr. E. J. Wellens, of Hebden Bridge, was transferred from the rank of associate to that of member.

Papers and Discussions.

The technical part of the business was then commenced by Mr. J. Whyte, of Seaham Harbour, reading his paper on "The Zigzag Flue for Heating Secondary Air," which will be found on p. 225. He was followed by Mr. E. E. J. Anderson, who read a paper on "The Future of Gas," given on p. 227. Both papers were well discussed. Subsequently,

Mr. T. Bower (West Hartlepool) said he had great pleasure in proposing that the best thanks of the meeting be given to Mr. Whyte and Mr. Anderson for their papers. It was only those who had written papers who know the time and thought it was necessary to bring to bear upon a subject in order to prepare them. But it was not on this account alone that they had pleasure in recording their vote of thanks. It was also because of the information imparted to them through the reading of the papers, and by the members relating their experiences. It was, perhaps, more on the latter account that they had to thank the two gentlemen named in the resolution for taking the trouble to put before the meeting such subjects as would bring forth discussions, to the benefit of the Association, and of the members individually.

Mr. J. Eadington (Blyth) seconded the motion; and it was cordially agreed to.

Election of Office Bearers.

It was reported that the ballot had resulted in the following being elected as office-bearers for the year:—

President—Mr. F. P. Tarratt, of Darlington.
Vice-President—Mr. E. E. J. Anderson, of Middleton.
Auditor—Mr. C. H. Armstrong, of Walker.
Hon. Secretary—Mr. H. Lees, of Hexham,
Members of Committee—Mr. M. Leaf, of York, and Mr. J. Lewis, of Newcastle.

Mr. Tarratt and Mr. Anderson returned thanks for their appointments.

Place of Next Meeting.

It was agreed that the autumn meeting of the Association should be held at Darlington.

Votes of Thanks.

Mr. Leaf proposed that the thanks of the Association be given to the Committee for their services during the year. He made special mention of the name of Mr. J. H. Penney, of South Shields, the former Hon. Secretary, as one who had done much yeoman service for the Association.

Mr. Drury seconded the proposition; and it was also agreed to.

Mr. Penney having acknowledged the vote,

Mr. Gibb proposed a vote of thanks to the President, who, he said, was energetic and enthusiastic in all he did, and who had brought that enthusiasm and energy with him while conducting the affairs of the Association.

Mr. Tarratt seconded the motion, which was carried by acclamation.

The President thanked the members for the way in which they had responded to the proposal, and for the help they had given him, which had enabled him to get through his year of office fairly well,

This concluded the proceedings.

The members and their friends, to the number of about eighty, dined together in the hotel, with Mr. Walker as Chairman. A toast-list was gone through, which was kept so admirably short that at five o'clock all were in readiness to betake themselves homewards.

EXCAVATIONS FOR SEWERAGE PURPOSES AND UNACCOUNTED-FOR GAS: AN EXPERIENCE.

By E. G. SMITHARD, King's Lynn.

[**A Paper read before the Eastern Counties Gas Managers' Association, April 22.**]

I think it advisable to preface my paper by claiming your indulgence for the lack of the technical matter that one naturally expects in a contribution to the proceedings at a meeting of this character; for I regret my inability to introduce anything novel of such a nature. On this account, it was with some diffidence and apprehension that I reluctantly acceded to the wishes of our esteemed President to place on record an account of my experience in the subject under notice, extending over the past four years. At the same time, I am not unmindful of the fact that there is a growing disposition on the part of municipal authorities to discharge their responsibilities in regard to public health, by improving sanitation and drainage, which necessitates the carrying-out of extensive sewerage operations; and as it is not improbable that some of the members may be called on, sooner or later, to face a scheme of this character, I am led to hope that this account may be of some assistance in overcoming the trouble which, in a greater or lesser degree, will inevitably follow.

It will be evident that the subject is of more importance to those in charge of a gas undertaking owned by a company or by private individuals; for where it is otherwise, the municipal authorties, who have the gas-mains under their control, are familiar with the position of the pipes in the streets and roads. Hence it is natural to assume that they will arrange the sewers so as to come into contact with the gas-mains as little as possible, consistently with efficiency; while the persons who have the supervision of the operations will be equally interested in both systems, and will take every possible precaution to prevent the gas-mains being damaged. In addition to this, the resultant loss is borne by the whole of the ratepayers, for whose benefit the scheme is inaugurated.

The liability to damage is greatest in the smaller towns, for, speaking generally, the streets will be found narrow and winding (as is the case in the town I am connected with), and therefore the sewers must, of necessity, frequently cross from one side to the other, in order to obtain the requisite straight line for the satisfactory discharge of the sewage; and in so doing, they will be in close proximity to and cross the gas-mains, which are generally laid parallel to the kerb. Where they are under the pavement, as is the case in some towns, the liability to damage is reduced to a minimum. It is at the point where the trench and main separate that the damage is likely to occur, especially if they have been in company for some distance; and the damage may consist of fractures or drawn joints, depending on the power of resistance of the main itself and the extent of the subsidence. The mains in small undertakings are of less diameter, and consequently more susceptible to breakage and disjointure than is the case with those of greater dimensions.

The sewerage scheme under notice was commenced in the autumn of 1898; the work being entrusted to local contractors, who started the excavation in September or October in that year. For three or four months the work was carried on without any appreciable effect on the Company's distributing plant; but early in 1899, a report was received of an explosion in one of the inspection chambers, put in under the sewerage scheme. On investigating the cause, a 2-inch main was found to be broken in the site of the sewerage trench, which, of course, had been filled up some time previously. The escaping gas had obtained easy access into the chamber, which, I assume, should have been impervious to it. The leakage might have continued for a longer time had it not been discovered by some boys, who were unable to resist the temptation afforded for a cheap fireworks display. Fortunately, nothing serious resulted, the boys escaping uninjured, but somewhat alarmed by the explosion.

From this time onward, leakages from drawn joints, broken mains, and services were discovered in the districts where the excavations had been in progress, the following being a few examples: An 8-inch main was exposed in the trench for a distance of about 70 yards, supported by chains from timbers placed across the trench; the excavation being about 18 feet in depth. Owing to the tidal water getting into the trench, the earth was washed out from behind the waling, causing the timbering and sides to subside bodily about 16 inches. The gas-main withstood the strain without fracture, but many of the joints were drawn; and as there was every appearance of further subsidence, it was considered advisable to cut the main adrift until the ground had settled sufficiently to allow of its being relaid. Another 8-inch main was exposed in a trench for some distance, supported in a similar manner to the former; and when the ground was opened out later, it was found to have settled 6 inches, and many of the joints were leaking. A 4-inch main was on the side of the trench in another part of the district, and during the night, in consequence of heavy rain, the surface water broke into the trench, washing down the sides. The main, left unsupported, collapsed under the strain, and the escaping gas became ignited from tne watchman's fire. The man who was in charge of the sewerage operations endeavoured to extinguish the flames by throwing on water, but finding his efforts were unavailing, sent for the Company's man, who had the trench filled in, and thus put an end to the conflagration. Other mains, 2 inches, 3 inches, and 4 inches in diameter, were broken in the trenches, and the joints of branches drawn entirely out of the leading or trunk main in several instances.

The localization of the damage in some of the cases that came under our notice was very difficult and troublesome, owing to the soft nature of the ground where the excavations had been carried out and the ease with which the gas travelled in it, sometimes into another part of the district. The following are a few instances: Early in 1899, one afternoon about 4.30, a report was received at the office of a "bad" escape of gas at a fishmonger's shop in the town; but, unfortunately, the man to whom the report was given did not appreciate the serious nature of the notice, and thought that the next day would be "time enough." This, however, turned out to be otherwise, for at 9 p.m. there was a violent explosion on the premises, the gas being ignited by the fire burning in the grate; for although the tenants had taken the precaution not to light up, considering the escape too serious for this, the danger of ignition from the fire did not apparently occur to them. As a consequence, the premises were wrecked, window casements, match-boarding, hearthstone, floor, and marble fish slab were all displaced; and it was remarkable that the man and his wife, who were in the house at the time, escaped without injury. The Company's men were summoned; but nothing could be done until the next morning, when they were early on the scene. The flags in front of the shop were taken up; but there was no trace of an escape of gas from the service or main. The search was continued under the floors to the rear of the premises, and after several days' excavating we discovered an old brick drain through which the gas was entering the house; and on tracing it back to an adjoining street, we found the 3-inch gas-main broken in the sewer trench. Between this and the premises where the explosion occurred there were half-a-dozen tenements; but the tenants were not troubled with the escape.

Another explosion occurred in a house in the district, where the windows were blown out and pictures and furniture damaged. In this case, the tenant had not a supply of gas laid on—in fact, the nearest gas-main was over 100 yards distant. As in the previous case, the cause of the explosion was a broken main, 4 inches in diameter, in the sewer trench; the gas having travelled along an old brick drain which must have been connected in some way with the premises in question.

A further instance, illustrating the difficulty experienced in locating the leakages, occurred in a street paved with granite sets laid on a concrete bed; the pathway being flagged. The tenants of two of the houses complained of an escape of gas on their premises, and, after examination, the flags outside were taken up; but although the indicators were tried, they did not register any escaping gas. The nuisance continuing, however, the main was bared near the premises, with no better result. The process of examination of the mains and services was continued throughout the street and into the adjoining ones, without success, for nothing was discovered to account for the smell in the houses, which became worse as time went on. At this stage, we were being pressed by the tenants and Corporation to abate the nuisance; so that the situation was both unpleasant and perplexing. However, by excavating deeply under the pavement in front of the house, we came across an old barrel sewer, 2 feet 6 inches in diameter, which, on being broken into, was found to contain a large percentage of coal gas.

Owing to the area of the culvert, it was difficult to ascertain the direction from which the gas came; but the sewer was opened at various points and blocked up with earth, until the gas was confined into a smaller space, until at last it was found to be entering through a small brick drain. This, on being traced, led to an earthenware pipe, and thence into the sewer trench. The pipe had apparently been cut off when the new sewer was put in, but had not been stopped up in any way. The cause of the trouble turned out to be a broken service-pipe which crossed the sewer trench. Being rather shallow, and not properly supported when the ground was filled in, it had given way at a socket joint, probably in ramming the trench; and the gas, being unable to break through the crust of the road, found a means of exit along the trench and through the channel described. The search for this leakage occupied the attention of the Company's men for upwards of two months; the cost of paving and reinstatement of roads alone amounting to upwards of £25.

By the end of March, 1899, it was evident that the excavations were causing serious damage to the Company's property; the increase in the work of the distribution department necessitated the employment of additional men, and the March quarter's rental account showed a marked increase in the quantity of gas unaccounted for. It was at this juncture that my Directors decided to take legal advice as to the liability of the Corporation or their contractors in the matter generally; and the case was submitted to Counsel, who advised, briefly, as follows—viz.: (1) That the Corporation is liable for all damage caused to the Company's property by the subsidence consequent on the excavations for sewers. (2) That unless the Company are in a position to establish negligence against the Corporation—that is, a want of due care and skill in excavating for and laying the sewers, having

regard to the close proximity of the Company's mains—they have no right of action for damages against the Corporation, but must claim compensation under section 308 of the Public Health Act, 1875. (3) Generally, it appears that the Company have a good case for claiming damage under section 308 of the Public Health Act, 1875.

As a result of this advice, a claim was sent in to the Corporation, made up to the 30th of June, 1899, for loss of gas and cost of repairs, amounting to £195. To this the Town Clerk replied, on the 13th of September, that "they do not admit any liability in the matter." This reply was also submitted to Counsel by the Company's Solicitors, who pointed out that the onus of establishing the damage, compensation, and liability was apparently upon the Company, and that if this interpretation were correct, the question was whether the Company, in order to save the limit of six months prescribed in the Public Authorities Protection Act, 1893, should at once bring an action claiming a mandamus, leaving the question of compensation to be settled by arbitration, if and when the question of liability was decided in favour of the Company. Counsel further advised that unless the Corporation admitted the damage and the amount of compensation claimed, the Company should proceed to appoint an arbitrator under section 180 of the Public Health Act, 1875.

In order to bring the matter to a definite issue, the Company's Solicitors issued a writ against the Corporation; but subsequently an interview was arranged between the Directors and the Town Clerk, at which the latter made an offer, without prejudice, on behalf of the Corporation, practically equivalent to half the claim, in settlement up to Sept. 30, 1899. As at the time the Company's Solicitors were under the impression that a portion was not recoverable, being outside the six months' limit prescribed in the Public Authorities Protection Act, 1893, it was resolved to accept the offer. This cleared the way up to the date in question; but the work was still in progress, and was not completed until May, 1901. The damage and leakage became greater as time went on, recurring in several instances where things had been previously put in order. The men were engaged the whole of the time repairing the breakages or searching for them, until the end of the year mentioned above (1901); and a glance at the following table will show there was still a large field for further research:—

Table of Increases in the Quantity of Gas Unaccounted for Over Corresponding Period in 1898.

Quarter Ending.	1899. Cubic Feet.	1900. Cubic Feet.	1901. Cubic Feet.
March 31	406,000	581,000	1,261,000
June 30	95,000	195,000	457,000
Sept. 30	228,000	286,000	467,000
Dec. 31	500,000	546,000	1,357,000
Totals	1,229,000	1,608,000	3,542,000

About the end of the year 1901, we had repaired practically all the breakages that were known to exist; so it was decided, on the recommendation of the writer, to make a systematic test of the whole of the district, and a temporary inspector was appointed for the purpose. The method of testing adopted was similar to that so ably described by our friend, Mr. W. B. Randall, of Waltham Cross, in a paper read before the Southern District Association*—viz., by leakage indicators. This system was considered by the writer to be the most satisfactory, causing no inconvenience to the consumers, through being temporarily deprived of their supply of gas, and being independent of the uncertainty of bladders, main cocks, &c.; while the cost is less than by any other method.

The leakage indicator, as is probably well known to you, is a small clock-like instrument with a diaphragm of porous material, through which a mixture of gas and air will percolate, and is operated by the well-known law of diffusion—*i.e.*, the velocity of diffusion of different gases is inversely proportionate to the square roots of their densities. Thus, 4 volumes of hydrogen will pass through the diaphragm in the same time that 1 volume of oxygen is able to do; the latter gas being sixteen times as heavy as the former. The mechanism of the instrument is very delicate, and actuates a pointer on the graduated dial, indicating the percentage volume passing through the diaphragm. It is extremely sensitive, and will indicate the most minute leakage of gas. The mode of procedure in the testing is as follows: First, obtain the position and depth of a socket on the main, then drive down a bar, $\frac{3}{4}$ inch or $\frac{7}{8}$ inch diameter, by the side until it is level with the bottom of the joint. The bar is then withdrawn, and without loss of time a receiver, with the indicator attached, should be placed over the hole. (Various forms of this portion of the apparatus have been tried, such as clay, funnels, india-rubber, &c., but the one in use here is made of brass tube, 3 in. by $1\frac{1}{2}$ in., with a flange at one end 3 inches diameter, the other being made to fit the indicator.) A little sand is packed round the flange to prevent, as far as possible, the escape of gas from the receiver, or diffusion with the atmosphere. Observe the pointer on the dial; if stationary at zero, there is no leakage. Then, another hole is tried at the next joint; the testing being continued until an indication is obtained, after which the holes are made at shorter intervals, about one yard apart, until the maximum percentage point is reached, when the ground should be opened and the defect made good.

* See JOURNAL, Vol. LXXII., p. 1098.

I cannot speak too highly of the claims of this instrument, for with intelligent use it rarely fails to indicate the exact position of the leakage; the exceptions being only when there are extraneous circumstances in connection with the ground underneath, such as trench waling, sewers, drains, or recently excavated earth, where the filling-in materials consist of loose rubble, bricks, &c., through which the gas may travel easily a considerable distance from the point of escape. The testing was commenced in January, 1902, and completed in August. The number and particulars of leakages are given in the following table:—

Main-Testing Table.

1901. Month.	Length Tested. Yards.	Leaky Joints.	Broken Mains.	Bad and Broken Services.	Total Defects Found.
January	1,265	36	3	1	40
February	1,937	40	6	10	56
March	3,045	54	3	1	58
April	3,894	49	4	9	62
May	3,017	30	1	3	34
June	2,793	45	—	5	50
July	2,687	27	1	2	30
August	350	5	—	2	7
	18,988	286	18	33	337

Increased Quantity of Gas Unaccounted for Before and After Testing.

Quarter Ending.	Increase over these Periods in 1898. 1901. Cubic Feet.	1902. Cubic Feet.	Result of Testing. Decrease. Cubic Feet.
March 31	1,261,000	805,000	456,000
June 30	457,000	277,000	180,000
Sept. 30	467,000	14,000	453,000
Dec. 31	1,357,000	127,000	1,230,000
Totals	3,542,000	1,223,000	2,319,000

I think it advisable to point out that the foregoing does not include the streets that have a concreted carriage way; it will be evident to the members that this method of testing is not applicable to such cases. By the end of September, all the defects discovered had been made good. They were generally in close proximity to the sewer trenches, and many of them clearly attributable to subsidence following the excavations. As a result of the testing, it will be seen from the table that by the end of the March quarter the quantity of gas unaccounted for, as compared with the year previous, was reduced by 456,000 cubic feet; June quarter, 180,000; September quarter, 453,000; and December quarter, 1,230,000—making a total of 2,319,000 cubic feet. The last two quarters have apparently reached the normal figures of 1898, when the sewerage operations were commenced. The difference of 141,000 cubic feet may be attributable to other causes. It is therefore quite reasonable to assume that the excavations were responsible for most, if not all, of the damage. Indeed, after the first quarter's testing, from the nature of the leakages discovered it was evident that a claim could be substantiated in a court of law, if necessary, or before an arbitrator. Hence a *résumé* of the case was placed before an eminent expert Counsel, who had been engaged in a similar case for the Shrewsbury Gas Company; and, acting on his advice, a claim was sent to the Corporation as follows: For loss of gas since settlement in 1899, labour and general repairs; prospective loss of gas; and prospective loss through labour and repairs.

On receipt of this, the Corporation appointed a small Committee to consider the matter, and, acting on the advice of the Town Clerk, offered an amount equivalent to about one-third of the claim in settlement. Although my Directors were desirous of settling the question without recourse to legal proceedings, they considered the amount insufficient for a compromise, but left it in the hands of the Chairman, who at the time was also Mayor of the borough (fortunately for all parties concerned, I consider) and the negotiations between this gentleman and the Town Clerk resulted in a settlement being effected on the Corporation undertaking to pay a sum equal to half the amount of the claim. At the same time it was agreed that when the Company were compelled to excavate for the purpose of repairing leakages caused by the sewerage works, the Corporation would make no charge for the re-instatement of roads and pavements.

It is gratifying to record the termination of the case in this manner; for if it had gone to arbitration, both parties must have been involved in costly litigation. I consider the satisfactory ending was due in a great measure to the foresight and sound judgment of the Chairman and the Town Clerk, acting, respectively, on behalf of the Company and the Corporation; and their services in the matter are deserving of the appreciation and thanks of the shareholders and ratepayers alike.

In concluding my paper, I think it desirable to impress on the members, who may be called upon to undergo a similar experience, the importance of appointing a thoroughly competent person to look after the interests of the gas undertaking while the work is in progress, whose duties shall include the following—viz., to keep a record of everything connected with the operations as they proceed, the condition and positions of mains and services, and to see that they are properly supported; test all joints exposed, and have them set up where necessary; make note of positions of old sewers, drains, &c., and take care they are cemented up where disconnected in the trenches; confer with the authorities in charge of the sewerage works, with a view

to the avoidance of contact with the gas-mains as far as possible; and call their attention to anything likely to bear on the question of damage. If this suggestion is adopted, it will greatly assist in the prevention of a good deal of damage, and facilitate the work of repair after the subsidence which will inevitably follow.

Discussion.

The PRESIDENT (Mr. E. W. Smith), in inviting discussion, remarked that the paper was out of the common run; and it was one which they might regard as a quarry from which most of the members might select a stone.

Mr. J. H. TROUGHTON (Newmarket) said the paper was highly instructive to himself at the present time, inasmuch as at Newmarket they were at the end of a sewerage scheme which had occupied the town authorities for the last three years; and during the whole of the time the excavations had been going on, there had been a gradual increase in the leakage of gas. In the first year of the operations, the leakage went up by about 1½ per cent. above what was then the normal; the second year it went up 2 per cent.; and, at the present time (the scheme was practically finished), the leakage had risen about 3 per cent. above the normal. His Company had made a claim, but they did not know exactly how it was going to be entertained. They had taken Counsel's opinion, and were advised that they had a legal claim against the town authorities for the extra loss. Before the scheme was commenced, the Company gave the town authorities notice that they would hold them responsible for loss; and, to safeguard the Company's interests, they appointed a representative to look after the mains and the services—to see that they were properly protected and shored up where necessary, and generally to make a note of any breakage or loss, and, in addition, to take the position of the mains and service-pipes. A loss of 3 per cent. above the normal meant, in round figures, something like £1500 in the three years. The Company were advised that they could substantiate a claim, and that the loss could be recovered either in an action-at-law or by arbitration (which appeared to him to be the best way), or by settling the matter by a friendly conference. Up to the present time, the Council had treated the matter rather indifferently; and the Company had decided to proceed to arbitration, unless the Council made a reasonable offer. As in the case of Mr. Smithard, most of the loss had been occasioned by subsidence—for instance, where a gas-main happened to run parallel with the sewerage excavations for a distance of (say) 100 yards or more. It depended a good deal on the nature of the soil. After a time, subsidence took place, and the sides fell away. It was possible, in fact, for a gas-main that was laid alongside a sewer to gradually become exposed by the sides crumbling away. The gas-main was then strained, the joints were pulled out, and consequently there was leakage. There was a good deal to be said, he thought, in regard to these matters as to the character of the soil. In Newmarket it happened that the soil was of a sandy nature; and, when a leakage of gas took place, the sand being light, it travelled a considerable distance—making the leakages very difficult to locate and stop. Where there chanced to be an old drain-pipe, or access to old drain-pipes, the gas was naturally drawn that way; and, in some cases, he found it was drawn up the private drains and closets—the result being a nuisance and complaints. The Company thought the loss should be borne by the District Council; and they were advised that not only were they liable for past loss, but for prospective loss. The Company considered they ought also to be made to pay for the extra work that had been involved in searching for, and attempting to prevent and stop escapes. He thought about adopting a similar plan to Mr. Smithard's; and seeing that the sewerage scheme was just about finished, now was the time to have a thorough inspection. During the period the excavations were going on, a careful note was made of the defective service-pipes; and these were to be renewed. He must say the District Council endeavoured to meet the Company as far as possible while the excavations were proceeding; and they carried out his (Mr. Troughton's) instructions exactly, shored up every pipe that required it, and took all reasonable precautions. But no matter what was done at the time excavations of this kind were going on, leakage would inevitably follow. They could do their very best in the way of shoring up mains and services, but, if the mains ran parallel with the sewers, there would of necessity be subsidence and leakage. The Company had been on friendly terms with the District Council for many years, and the latter were large customers; so that the Company would be very sorry if they had to promote an action-at-law over what they believed was a legitimate claim. He hoped sincerely a friendly settlement would take place. The Company did not forget that they were large ratepayers; and if they succeeded (as they thought they would) in an action, it simply meant that what was a reasonable claim now, if costs were added, would amount to a very large sum indeed. They would probably in the end be very little better off; while the ratepayers would be much worse off. There was one question with regard to the author's first table. In 1899, it showed the leakage was 1,229,000 cubic feet; in 1900, 1,608,000 cubic feet; and in 1901, 3,542,000 cubic feet. Was that over and above 1899, or was it the actual leakage above the normal?

Mr. SMITHARD: Above the normal of 1898.

Mr. TROUGHTON concluded by saying that the paper contained many hints which he should undoubtedly adopt to bring his leakage down to the normal.

Mr. F. PATERNOSTER (Felixstowe) asked the author what the totals mentioned in his paper represented as percentages on the make. He thought Mr. Smithard had been speaking of the same indicator that he (Mr. Paternoster) had had experience with; but, personally, he had found it rather unreliable. He should like to see the author's means of testing. When he (the speaker) went to Felixstowe, the leakage was very heavy indeed. He believed it had been as high as 20 per cent. In the March quarter of last year, it was 15·6 per cent.; and this year he had managed to get it down to 6·5 per cent. But the most reliable indicator he had had there had been the syphons. At Felixstowe they were in a position which a good many towns did not occupy. There was a good deal of water in the roads; and if there was any leakage there was trouble immediately with the syphons. By their means he had been able to stop a great deal of leakage. Still he was glad to hear something good of the indicator with which Mr. Smithard had been testing.

Mr. R. G. SHADBOLT (Grantham) said he should like to throw out a suggestion that was made to a friend of his in Yorkshire who had to face a sewerage scheme, and who had found the suggestion acted very well. It so happened that down the streets and roads where the sewer had to be laid, it was in such a position that nearly all the service-pipes had to cross the trench. His friend put a stout spar of timber under each service-pipe. He (Mr. Shadbolt) had recently occasion to inquire how this had acted; and he found that the shoring up of the service-pipes in this way had had the desired effect. Prevention being better than cure, these spars were better than any amount of litigation. In the author's main-testing table, it was seen that there were 33 broken services, as against 18 broken mains; so that, even in this case, a great proportion of the leakage might have been prevented had any means been taken which were sufficient to prevent the service-pipes subsiding with the ground. One might point out in these days of electric light competition, that there were other causes of damage to gas-pipes besides sewerage operations. Of course, their friends the electricians liked to be above rather than below them; and they did not forget to put their picks through the gas-pipes, and cover the damage up with a piece of clay, or something of the kind. As a general rule, whatever could be done by acutely watching the progress of work, whether it be electric lighting or anything else, to prevent possible leakages of gas would remove a cause of a great deal of friction with the local authority, and prevent considerable loss of gas.

Mr. C. G. GRIMWOOD (Sudbury), speaking of a sewerage scheme in his town which caused the leakage to go up, said that, in their case, they noticed a good deal of damage to services by the navvies putting their picks into the pipes. At first, they thought of giving a little premium to the men who would give them notice as to a pipe having been damaged; but, on second consideration, they came to the conclusion that, if they put a premium on damaged pipes, they might have more of them. They treated it more politically, by charging nothing for the repairing of the pipes. If they charged for the repairing of the pipes, it was thought that, every time there was damage, they would simply get a piece of clay put in to fill up the hole. Therefore the men and the foremen were told that, if they would send down to the gas-works when a pick was put into a pipe, it should be repaired as soon as possible. This plan was found to be the better one. At Sudbury, the Company were unauthorized; and he was afraid that, being in such a position, they had no claim against the Corporation for any damage. They therefore took the precaution of informing the contractors on the work being started, that they would be held responsible for damage. Whether they would be able to sustain any claim against them, he did not know. The leakage, he was glad to say, had only increased about 2 per cent.; but he hoped—the sewerage operations having only just been finished—it would not go up more.

The PRESIDENT agreed with Mr. Paternoster that it would perhaps have been better, and the members would have understood the proportions of the leakage better, if they had had percentages instead of totals. Mr. Troughton had spoken of an increase of 3 per cent. over and above the normal; but that he (the President) would, if the sewerage operations had been fairly extensive, consider a very slight increase, compared with what Lynn would be. He had not worked the increase out; but he was under the impression that he had heard the leakage was something like 20 per cent., and it must have gone up 6 or 8 per cent. at least. With reference to sewers running parallel to the services, it had been suggested that one means of safeguarding the services from subsidence would be to place under each a strong piece of timber; but he was not sure that this would be sufficient if the ground subsided not only over where the trench had been made, but also at the sides. A piece of timber unless it was carried a distance of 6 or 8 feet on each side of the trench would give more or less. The method he adopted to prevent subsidence of the mains in some sewerage operations which were carried out at Chelmsford was this: To shore up the trench strongly, and strut it with stout pieces of timber—abutting on one side of the main and the side of the trench. The timber was left in, with the result that they had not found very much subsidence. His reason for doing this was that he felt the main would follow the creeping or settling of the sides of the trench; and this seemed to him to be the best means of dealing with the danger. Part of the expense was borne by the Corporation, who

were duly informed that they would be held responsible for loss from leakage. With reference to leakage indicators, he might say he had tried one of these at Chelmsford, with excellent results, for some time, and following, too, very much the same lines as the author of the paper had laid down. With the instrument, they had been able to locate leakages very easily.

Mr. SMITHARD, in reply, said he did not think the question of percentages had any bearing on the matter—for instance, if they had an increased output of 20 per cent. in one year, there would be no sign of the increased leakage on the percentage account. He meant to say that this was not a question of percentage at all. It was a question of what was the actual difference in the quantity of gas lost, caused by the sewerage excavations alone. As to Mr. Troughton's remarks, the nature of the soil was a very important question indeed. If it was alluvial, there was always a great deal more trouble through the gas travelling from one part of the district to another. With regard to the question by Mr. Paternoster, the leakage-indicator used, was one advertised in the "JOURNAL." It gave very excellent results—in fact, he thought the paper spoke for itself. A number of the leakages—all of them, in fact—were found by the indicator, and in a great many instances were located exactly on the spot where the damage had occurred. With regard to the strutting up of the service-pipes, he quite agreed that it was necessary, and in fact he recommended it in the conclusion of the paper, when he advocated the appointment of a competent person to look after, among other things, the strutting up and filling in of the trenches when sewerage work was in progress. But it was not always that the service-pipes gave way in the trench; it was often found that the breakage in the service-pipe was a joint perhaps some 5 or 6 feet away. Sometimes a main would absolutely drop right away from its original line. Then, of course, the service-pipe must give way somewhere. He had often found the damage to the service-pipe was not in the trench at all, but a considerable distance away, so that strutting in such a case would make no difference. He found little damage from ramming; but it was occasioned more or less by the drawing of the service-pipes. As to pick holes and small plugs, they were found in his case; but it would have taken up too much time to put all these things in the paper. As to Mr. Grimwood's remarks, he (Mr. Smithard) asked the men to give notice at the Company's office of any damage that they did while it was exposed. They also offered them a premium for so doing; but they did not find this had much effect on the men.

BLUE WATER GAS AND ITS ENRICHMENT BY THE PEEBLES OIL GAS PROCESS.

By E. J. BROCKWAY, of Cleethorpes.

[A Paper read before the Eastern Counties Gas Managers' Association, April 22.]

At the present time, probably more than at any other period in the history of gas manufacture, economy in the cost of production is the chief problem occupying the minds of gas engineers and directors. Regenerative furnaces, inclined retorts, mechanical and labour-saving appliances from the retort-house right through the processes of condensing, exhausting, and purifying, to storage, have all, more or less, received our consideration; the chief object in view being to cheapen the cost of production, or, in other words, to produce a cheap gas of sufficient calorific value to meet the changing conditions of modern gas supply and distribution, and at the same time to comply with the statutory regulations respecting illuminating power.

Carburetted water gas on the Lowe system has been largely adopted; and it was in this direction that I turned, when a year ago I saw that a prompt increase in productive power was imperative. After, however, careful inquiry into the working and the results of various plants, I was somewhat disappointed to find that, excepting in ground space and capital expenditure on plant, I could not hope to reduce the cost of production much, if any, below that of coal gas. While making inquiries, I had brought to my notice the Dellwik water-gas plant, and a suggestion that it and a Peebles oil-gas plant would make an excellent combination caused me to institute further inquiries, and eventually to adopt it in preference to the Lowe type of apparatus. I may say that the first cost was practically the same, whichever process I adopted; but the high efficiency of the Dellwik plant for making blue water gas, with the Peebles process as an enricher, and the ease with which I could produce blue water gas, carburetted water gas of any desired candle power, or, if desired, oil gas alone, gave, I considered, such advantages in the variety and range of working that I came to the conclusion that this combination would enable me to produce what I found to be the most suitable gas at the lowest price. Whether my ideas were correct or not I must leave it to you to decide, after you have heard the results of my short experience.

It will, perhaps, be best if I describe the two processes and plants briefly, and then give some particulars of the experiments, and the results obtained.*

* For an illustrated description of the plant arranged at Cleethorpes, see "JOURNAL" for March 24, p. 754.

The process of water-gas manufacture consists in the alternate heating of a bed of fuel to incandescence by means of an air-blast, and the subsequent decomposition of steam in contact with the fuel thus heated, until the decrease in temperature necessitates a new period of heating. The blue water-gas plant we have is of the ordinary Dellwik type (shown on the sectional drawing, fig. 4); the generator being 7 ft. 6 in. in diameter by 14 feet high, and designed to produce from 10,000 to 15,000 cubic feet of blue water gas per hour. The blast-pressure is obtained from a Roots blower, and varies from 8 to 12 inches of water. The blower supplying the air has a positive action. Whether the fuel is compact or open, the same quantity of air is delivered. The blowing-up periods vary from 1 to 1½ minutes; and it is noticeable that during the blow, after a fresh charge, for the first minute there is no flame showing at the stack-valve on the generator top, although the quantity of air passing is at least 4000 cubic feet per minute. During the next two blows the flame appears earlier each time, and consequently the time of blows is shortened. The gas-making periods vary from 8 to 12 minutes. I have in use a Thorp and Marsh "Water Gas Cycle Recorder," which shows accurately the lengths of the blows and runs. The steam is supplied from the boiler which supplies the steam for the exhauster, pumps, conveying plant, and to the works generally. The working pressure is 100 lbs.; and before entering the generator the steam is superheated by means of the hot gases from the generator.

The labour required to work the plant is very small indeed. The coke is raised by a hydraulic lift to the working platform supporting a hopper holding sufficient coke to last from four to six hours, and the gas maker fills his charging waggon from the coke-hopper during the period of gas making, and also attends to the blower and exhauster. The plant is so exceedingly simple in construction and arrangement that the man has not to leave the operating stage to work any portion of the blue water-gas plant—one set of gearing operating all the necessary gas and air valves. The blue water gas, after passing through a scrubber, is stored in a relief holder, from that point to be enriched by means of oil gas. I have fitted up on the works one of Messrs. Alexander Wright and Co.'s new water-gas photometers, and connections have been laid so that we can test the gas at various points up to the inlet of the holder. I may just say here that our parliamentary standard is 14 candles; but using, as we mostly do, South Yorkshire coals, the quality sent out averages 16½ to 17½ candles.

The blue water-gas plant was set to work in December of last year, and at once proved of great service, as we were then working to the full extent of our carbonizing plant. As the oil-gas bench was not quite finished, I decided to pass a certain proportion of blue water gas into the foul main of the coal-gas plant, in order to see to what extent the blue water gas could be mixed with the coal gas without injuriously affecting the illuminating and heating values of the gas sent out to the town. This was done by fixing a wrought-iron pipe from the outlet of the blue-gas relief holder, and passing it into the foul main, between the two benches of coal-gas retorts.

With 5 per cent. of blue water gas passing through our coal-gas foul main, no appreciable reduction could be noticed, and up to 10 per cent. the reduction was not more than ½ candle. With from 12 per cent. to 15 per cent., the reduction in illuminating power was from ¾ to 1 candle, varying to this extent according to the class of coal we were using. While experimenting in this way, it was soon noticeable that the introduction of the water gas was to some extent upsetting the normal conditions of the coal gas in its passage through the foul main and condensers. The make dropped from 10,800 to 10,300 cubic feet per ton. After satisfying myself that the reduced make was undoubtedly due to the water gas, and carefully noting the temperatures in the foul main, and the quality and specific gravity of the tar, I came to the conclusion that while the water gas undoubtedly picked up some of the lighter vapours, it brought about a deposit of some of the heavier ones, which otherwise, remaining in contact with the gas, became permanently fixed.

Reasoning this out, it seemed evident that the cause was traceable to the fact that the water gas entered the foul main cold. I have since then had fitted up the arrangement shown on fig. 1. From this you will see that before entering the foul main the pipe is carried into the coal-gas setting, over the retorts, and returned to the front, and from there into the foul main. I have only been able to experiment with this arrangement a few days. So far, however, there has not been any reduction in the quantity of coal gas per ton, but an appreciable increase; and the only point on which I am in doubt is how it will affect the quality and quantity of the tar. [Particulars of this experiment are given in Table II., at the end of the paper.]

The oil-gas plant and building adjoin the water-gas house. The buildings contain three arches of two retorts, fitted up on the Peebles system. The retorts are of cast-iron, 24 inches in diameter by 9 feet long, set so as to incline to the back end. They are fitted with lids and ascension-pipes in the usual way; but in each lid there is a pet-cock, by opening which the colour of the gas can be seen. The oil for supplying the retorts is fed from an overhead store-tank, and through the hydraulic main to a cistern containing a float-valve adjusted to give the necessary seal for the ascension-pipes. From the cistern it passes, through feed-cocks and syphons, down the ascension-pipes into the retorts. As the gas leaves the retort, it passes up the ascension-pipe, which

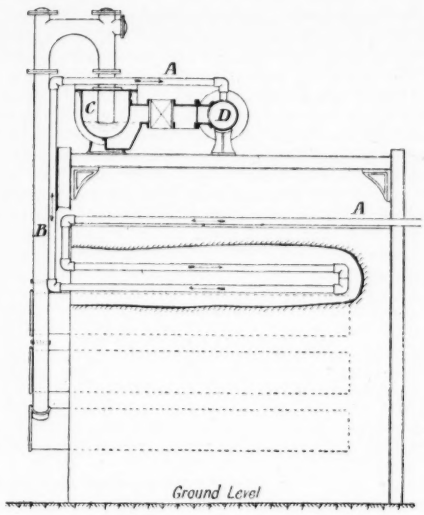


FIG. 1.—COAL-GAS RETORT-BENCH.

A. Blue Water Gas Inlet from Holder. B. Ascension Pipes for Coal Gas. C. Hydraulic Main. D. Fou Main.

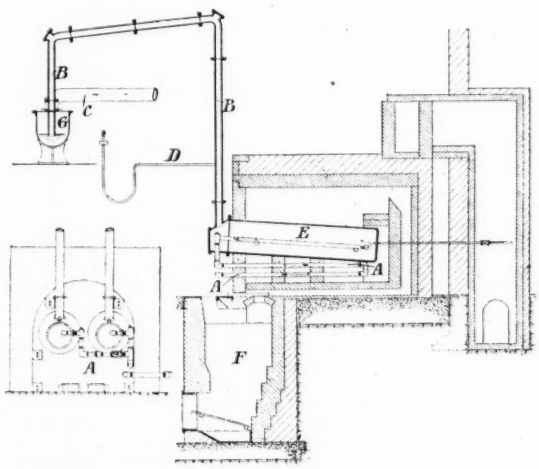


FIG. 2.—METHOD NO. 2.—OIL-GAS RETORT-BENCH.

A. Blue Water Gas from Holder. B. Oil Gas to Hydraulic Main. C. Carburetted Water Gas Outlet. D. Oil Inlet to Retort. E. Oil-Gas Retort. F. Furnace. G. Hydraulic Main.

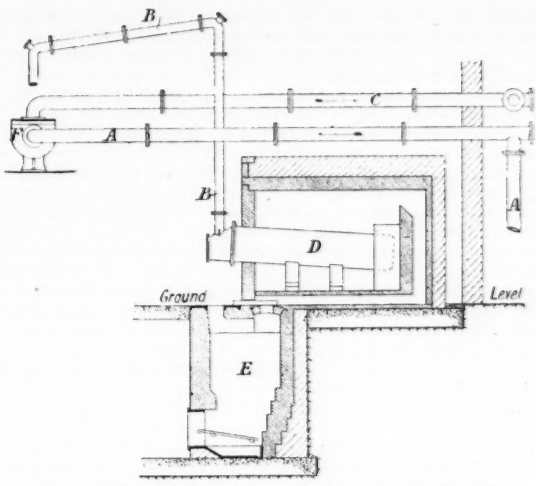


FIG. 3.—METHOD NO. 1.—OIL-GAS RETORT-BENCH.

A. Blue Water Gas Inlet from Holder. B. Oil Gas to Hydraulic Main. C. Carburetted Water Gas Outlet. D. Oil-Gas Retort. E. Furnace. F. Hydraulic Main.

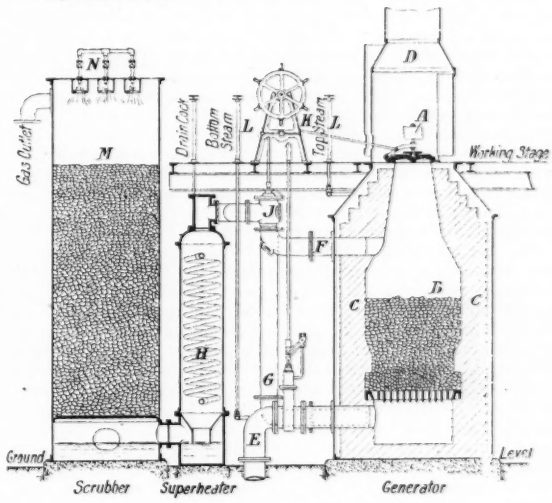


FIG. 4.—DELLWIK WATER GAS PLANT.

A. Stack Valve. B. Coke. C. Fire-Brick Lining. D. Chimney fitted with Spark-Catcher. E. Air-Blast Main. F. Top Gas Outlet. G. Bottom Gas Outlet. H. Steam-Coil. J. Gas-Valves. K. Gear for Opening Valves, &c. L. Steam-Cock Pillars. M. Coke Bed. N. Water Spray.

leads across the stoking-floor to the hydraulic main, fixed opposite the bench, to be mixed with the blue water gas in such proportions as may be necessary to make the desired quality of carburetted gas. [See fig. 3.]

This portion of the plant was completed early in the New Year, put at once to work, and after about three weeks' careful firing, necessary to thoroughly dry the retort-bench, we commenced to make oil gas and enrich the blue water gas. At first we carried the blue water gas from the relief holder direct to the oil-gas hydraulic main, mixing the gases as the oil gas bubbled through the seal. With two retorts we were able to pass 6000 to 8000 cubic feet of water gas per hour; the illuminating value of the mixed gas being 16 to 17 candles at the outlet of the purifiers. A test run was then made by the contractors, careful checkings of the coke and oil used being taken by myself, with the following results:—

Carburetted Water Gas Test.

[Test from 10.25 a.m. to 6.25 p.m., Feb. 12, 1903.]

Gas made	76,000 cub. ft., 17 c.p.
Oil used	165 gallons.
Coke used in generator	20 cwt.
,, ,, oil furnace	6 ,,
Oil per 1000 cubic feet	2·2 gallons.
Coke ,, ,, ,,	38·5 lbs.

Other tests, extending over several days, were afterwards made, all of which proved in every respect so satisfactory that I was able to provisionally take over the plant to work ourselves.

I had been told that in other works, in the ordinary working of the Peebles oil plant, the quality and quantity of the gas obtained fell away day by day after the plant had been started, until a certain standard was reached, owing to the residues which had been washed out from the gas and returned to the retorts tending to prevent the cracking-up of the fresh oil flowing to the retort. This difficulty, or defect, which is a very important one, seems in my case to be entirely overcome by the introduction of the blue water gas into the hot oil gases of the hydraulic main. The blue water gas takes up and holds in diffusion those volatile vapours that would otherwise have been condensed and returned to the retort, interfering with the cracking-up of the fresh oil. It is evident that the absorption of these volatile hydrocarbons does take place, from the fact that the yield of gas from each retort is considerably higher than has been obtained from similar sized retorts elsewhere when used for oil gas alone; and, in addition, the number of candles of enrichment per gallon of oil undoubtedly increased, as, although our working has been intermittent and irregular, a yield of over 8-candle power has been obtained per gallon of oil used per 1000 cubic feet. This has been considerably increased during the past two weeks.

The plant has been working regularly now for the past two months, six days per week, and during days only, shutting down each night and over Sundays. So far there has not been the slightest difficulty or hitch in the working, and our men have grasped the details of both the oil and water gas manufacture without any trouble whatever.

An ordinary day's working is as follows: Our gas maker, starting at 6 a.m., cleans out his fires, oils up the exhauster and blower engine and fills up his hopper with coke from the yard. This takes from 40 minutes to one hour. Allowing half-an-hour (the usual time) for breakfast, everything is all ready for gas making at 7.30. The works foreman turns on the oil supply to the retorts, and adjusts the proportion of blue water gas and oil gas to give the required candle power; after which, as a rule, as

regards the oil process, no further adjustment is necessary, beyond feeding the oil-gas retort furnace twice, and drawing the coke from the oil-retort at the end of the day. At about 4.30 in the afternoon gas making ceases, the oil-feed is shut off, the oil-furnace is filled, and the dampers are closed. During the period of working—viz., from 7.30 a.m. until 4.30 p.m., allowing an hour for dinner—there is no difficulty in making from 100,000 to 120,000 cubic feet of oil and water gas.

Respecting the cost of labour, from the details of a day's working which I have just given you, it will be seen that one man easily makes upwards of 100,000 cubic feet during a working day of ten hours. The only other cost under this head is purifying and extra boiler firing. The cost of labour in purifying works out to 0·12d. per 1000 cubic feet; and we pay our boiler attendants 6d. per shift extra for the additional firing required.

My experience shows that the yield of blue water gas obtained from coke varies considerably with the quality of coke used. We have obtained a yield of upwards of 76,000 cubic feet per ton from the coke of some of the high-class South Yorkshire coals; but our average make, week by week, is 69,000 cubic feet per ton, which includes all coke used (both when working and standing) during the week in the water-gas generator.

I have taken, very carefully, the actual cost per 1000 cubic feet of the blue water gas into our holders. It works out as follows:—

	Pence.
Coke	1·76
Labour	0·69
Purifying	0·12
Boiler fuel (breeze)	0·40
	2·97

The oil we use is Scotch oil, from Young's Paraffin Company, costing 2⅜d. per gallon. It is of ·865 specific gravity. The only residue is a good hard coke deposited in the retorts from the oil, and drawn at the end of each day's run. I have been carrying out some interesting experiments with the view of reducing the quantity of coke and obtaining better results from the oil. The first was to introduce the blue water gas into the oil-retorts; and for this purpose a hole was drilled in the centre of the far end of the retort, and a pipe laid to it from the blue water-gas relief holder. This was not at all a success.

Turning into each retort 3000 cubic feet per hour of blue water gas, the quantity we had previously passed direct into the oil-gas hydraulic main, the illuminating power rapidly dropped from 16½ candles to 14 candles—the oil-feed remaining the same. Shutting off the blue water gas from the retorts, and passing it again into the hydraulic main, the illuminating power just as rapidly rose to 16½ candles. The change was repeatedly made from one method to the other, with exactly similar results; and I was forced to the conclusion that the deterioration of the combined gases when passing blue water gas into the retorts was due to the fact that the radiant heat from the sides and top of the retorts materially assisted to permanently gasify the oil vapours, and that mixing the comparatively cool blue water gas with these vapours reduced their temperatures so that they were not completely decomposed into permanent gases.

A further experiment was to heat the water gas by carrying a 3-inch wrought-iron pipe (as shown in fig. 2) into the waste-heat flue of the oil-retort setting, then into the retort mouthpiece, and by a pipe to the back end of the retorts. Several days' working with this arrangement showed a distinct gain in the results from the oil, reducing the quantity used per 1000 cubic feet of 16½-candle gas from 2¼ to 1·98 gallons. The residual coke weighed out at 4¼ cwt. per ton of oil, against 4¾ cwt. when passing the blue water gas into the oil-gas hydraulic main.

I had hoped to be in a position to give the results of some experiments when introducing blue water gas into the coal-gas retorts, as advocated by Professor Lewes; but the short time I have had the plant at work has prevented experimenting sufficiently far in this direction. I have, as carefully as possible, worked out from the experiments we have made, and our working up to date, a statement giving what I believe to be the actual full cost per 1000 cubic feet of carburetted water gas by the combination process we have adopted; and I have every confidence that, in general every-day working, the total cost given will not be exceeded:—

Cost of Carburetted Water Gas per 1000 Cubic Feet of 16½-Candle Power.

	Pence.
Coke and breeze for oil gas and water gas	1·93
Oil, 2 gallons at 2⅜d.	5·25
Fuel for boiler	0·40
Purifying	0·12
Labour, including foreman's supervision	0·69
Wear and tear	0·50
Management and general expenses	1·00
	9·89
Less oil coke residuum	0·27
	9·62

In making the experiments on which the above figures are based, nothing has been guessed at or taken for granted. The coke was carefully weighed through a self-registering weighing-machine, the oil measured through an oil-meter, and the gas registered through a rotary meter and into a scaled gasholder. Tests were continuously made for illuminating power and impurities, and I had the assistance of Mr. H. F. Hills, F.C.S. (Professor Lewes's assistant), who carried out the analyses given in the tables at the end of the paper.

In conclusion, I can only say that the opinion formed from the inquiries I made before putting down the plant, has been more than confirmed by the results obtained in practical working. I hold no brief for any inventor or manufacturer, nor do I wish to disparage any other process; but I am satisfied that a combination of the Dellwik water-gas plant and the Peebles oil process, by its undoubted economy in production, and greater flexibility and range of working, has distinct advantages that will enable us to more effectually meet the rapidly changing conditions of modern gas supply.

Appendix.

Table I.—*Coal Gas Alone.*

Make per ton	10,800 cub. ft.
Illuminating power	15·85 candles.
Candle-feet per ton	34,236
B.T.U. per cubic foot	675 gross. / 605 net.
Carbonic oxide	4·8 per cent.
Cost in gasholder, per 1000 cubic feet.	15·5d.

Table II.—*Coal Gas + Blue Water Gas in Coal-Gas Foul Main.*

[The water gas was heated by passage through red-hot tubes before entering the foul main. See fig. 1.]

Crude water gas added	25 per cent.
Make per ton, including water gas	14,033 cub. ft.
Make per ton, deducting water gas	11,333 ,, ,,
Illuminating power	14·94 candles.
Candle-feet per ton	41,930
B.T.U. per cubic foot	599·8 gross. / 539·4 net.
Carbonic oxide	9·6 per cent.
Cost in gasholder, per 1000 cubic feet.	12·5 d.

Table III.—*Coal Gas + Carburetted Water Gas.*

Carburetted water gas added	50·3 per cent.
Illuminating power of mixture	16·66 candles.
B.T.U. per cubic foot	626·0 gross. / 563·2 net.
Cost in gasholder, per 1000 cubic feet.	13·1d.

Discussion.

The President said the subject of the paper was one which had given rise to an interesting discussion lately in the technical press; and he was sure the members generally had been deeply interested in the question, and many would be anxious to give their opinion upon it.

Mr. J. Carter (Lincoln) deplored the fact that the paper had not been distributed prior to the meeting, and said he thought it should be clearly understood that what was said on the question in the discussion was subject to a more complete and fuller consideration of the paper, which time only could afford the members the opportunity of giving. He was very much struck with a remark in one of the earlier passages of the paper. The rapidly growing business at Cleethorpes (upon which, naturally, the Cleethorpes Gas Company were to be congratulated, and with which the energy and enterprise of his friend, Mr. Brockway, had had a great deal to do) rendered it necessary for the author to look round for some subsidiary and considerable means of increasing his source of gas supply. That Mr. Brockway thought seriously about carburetted water gas was no surprise to him (Mr. Carter); it would have been a surprise to him if Mr. Brockway's thoughts had not been turned in that direction. However, after he had considered the matter, the author was led to the conclusion that, with the exception of an economy in ground space and in capital expenditure on the plant, he could not hope to effect a very great reduction in the cost of the manufacture of gas as between the Lowe system of carburetted water gas and coal gas. Now he (Mr. Carter) thought his friend was a little bit wrong either in his facts or his time. If Mr. Brockway had stated that five years ago carburetted water gas could not be made materially cheaper than coal gas, he would have been in a position to agree with him; but he ventured to say that twelve months ago, or even two or two-and-a-half years ago, inquiry as to the results obtained—the average results obtained—from the carburetted water-gas plants of this kingdom, would have carried conviction that gas of an equal illuminating power could be produced by carburetted water-gas plants at 2½d. to 3½d. per 1000 cubic feet less than it was possible to produce it by coal gas plant. The author remarked that whether his ideas were correct or not, he must leave it to his audience to decide; and his wise discretion on this particular point would commend itself to everyone. As to the cost of the gas under the system adopted, they could not gather what the exact cost would be if the manufacture of the gas were cut entirely apart from every other operation on the works. For instance, somewhere in the paper the author referred to the steam being supplied from the boiler which supplied the steam for the exhauster, pumps, conveying plant, and to the works generally. Then, again, with regard to the charges for labour for purifying and for extra boiler-firing, they were mixed up with the ordinary working. So that it was obvious to everyone that, under conditions and circumstances such as these, they did not get such a rigid and exact estimate of the cost of the two systems as they would do if they were kept separate and entirely distinct, and did

not, at any particular point, overlap and touch each other. Their friends of the Press were calling for facts rather than estimates and conjectures; and what they were still waiting for were complete statements entirely detached one from the other, showing all the charges of the cost of carburetted water gas, of water gas as his friend was making it, and the cost of coal gas on the other hand. Whatever might be their views on this subject, they must be faced by this fact, that matters in the gas profession had advanced at a very rapid rate during recent years. It was not so many years since—as some of the members would remember—that controversy was centred round the production of coal gas on the one hand, and carburetted water gas on the other. That controversy seemed to have been settled finally and once for all. Now the great question of controversy in the gas world to-day was not as to whether gas makers should produce coal gas or carburetted water gas, but rather in what form the water gas should be manufactured. The question had moved thus far. Then, with further reference to the paper, it appeared to him that the very minute adjustment of the proportions of the gases under this system must lead to the requirement of a great deal more personal and skilful supervision of this plant than was needed by a plant of the ordinary Lowe character. To the change of systems to which this particular plant could be adapted, he (Mr. Carter) attached very little importance indeed, because he honestly believed, as a means of supply, their application was distinctly limited; and they would not be of any real advantage or service to anyone of them when large volumes of gas were being required. What he wanted to know was if the slight percentage of blue water gas introduced into the hydraulic main was going to give him the increased source of supply which a rapidly growing district might render necessary. He did not think it would; and for this reason he attached to the subsidiary advantage which was claimed for this plant very little importance indeed. Coming to the real question as to the cost at which blue water gas *plus* oil gas under this system could be produced, he ventured to say—for reasons, some of which would be obvious from even a superficial study of its cost—that 18-candle carburetted water gas could be produced at a figure not one bit higher than the figures the author had submitted to the members in his paper. Knowing how scrupulously careful Mr. Brockway was, and as to how certain he would be before exposing himself to any adverse criticism at this meeting, he (Mr. Carter) approached the criticism of his figures with a good deal of diffidence. Still one item struck his attention, and excited his incredulity. It was the charge for purifying 0·12d.—that was, $\frac{1}{8}$d.—per 1000 cubic feet. He (Mr. Carter) naturally assumed, from figures of this sort, that the author was alluding to purification entirely by oxide. In order to understand these figures at all, he had to assume that the purification material did not cost Mr. Brockway a single fraction; and when he gave him that in, he must confess that he could not see how purifying operations by means of oxide could be conducted at as low a charge as $\frac{1}{8}$d. per 1000 cubic feet of gas made. He believed the author would find ample reason for somewhat enlarging that figure. It was also apparent that the fuel—being used in the generator for manufacturing blue water gas and under the retorts for manufacturing the oil gas—had a dual operation to perform, requiring the consumption of coke at two particular points. Therefore, from the very form of the plant, and from the nature of the operations conducted by Mr. Brockway, he must be faced with a constant and necessarily extravagant consumption of coke in the manufacture of the gas. He (Mr. Carter) ventured to say—not of one plant merely, but of many Lowe carburetted water-gas plants—that the consumption of generator fuel was considerably less per 1000 cubic feet of carburetted water gas than the figures incorporated by the author in the paper. Here he was reminded of a lecture recently delivered by Mr. Shadbolt to a Grantham audience, in which the lecturer protested, and very rightly protested, against the practice adopted by some controversialists in comparing two distinct and particular systems, of taking care to give the best results obtained by one system, and to hunt about for the worst results that could be obtained from the other—then pitting the two together, and claiming to have established a fair, legitimate, honest, and just comparison between them. Mr. Shadbolt protested against an idea like that in Grantham; and regarding the comparative costs of these competing systems of manufacturing water gas, he (Mr. Carter) protested against the production of belated figures from experiments carried out five or six years ago, and which made one or other appear in its worst light. If they were to have a just and fair comparison of the results that could be obtained from competing plant, then by all means let them take the best of one and the best of the other, because the best that could be obtained from a plant showed what it was capable of doing under good management. Then in a short time, they would see daylight through the controversy that was now being conducted through the Technical Press, which had been marked by considerable expression, and strength and vigour of language, and which had somewhat excited the occupant of an important editorial chair in Bolt Court. Could they but see a fair, just, and accurate comparison of figures in relation to the matter he had alluded to, it might be—it was more than likely it would be—the result that those who had adopted the newer system of the manufacture of blue water gas *plus* oil gas would be well satisfied with the selection they had made. But he had never yet met with a single fact (and he distinguished carefully between fact, conjecture, and estimate) which left him a doubt that those who had adopted the Lowe system would have any reason to regard their selection with anything but complacency.

Mr. JOHN BARTON (Peterborough), called upon by the President, said he was afraid he could not add much to the discussion. Through the kindness of Mr. Brockway, he had had the pleasure of seeing the plant at Cleethorpes; and he was particularly struck with its simplicity, and with the means that Mr. Bockway had adopted in making the tests, and to carry out the experiments successfully. He (Mr. Barton) thought, from his personal observation, that they might take it for granted that the figures the author had given were pretty well accurate. There was one item in the first table—coke 1·76d. per 1000 cubic feet—which seemed to him to be a very low figure indeed. He should like to know what price per ton Mr. Brockway charged for coke.

Mr. BROCKWAY: 10s.

Mr. J. T. JOLLIFFE (Ipswich) regretted that, through having had no practical experience in the manufacture of water gas, he was unable to adequately discuss the paper. However, he could not understand why Mr. Brockway had chosen this particular form of dual plant; and he should be much obliged to him if he would tell the members the reasons that induced him to have two plants instead of the Lowe system, which seemed to combine the two in one. Of course, they must, and did, accept Mr. Brockway's figures as accurate; but he, too, could not help noting that the figure for purification was very low. Neither could he see that there was very much difference in the results obtained from the coke and oil in this system as against the Lowe water-gas plant. From the information given him by the makers of the Lowe plant, he (Mr. Jolliffe) found that, they made practically the same quantity of gas per ton of coke as Mr. Brockway, and the oil was generally credited with yielding 8 candles per gallon, which was also practically Mr. Brockway's figure. This being so, he could not understand the advantage of having two plants to do the work which could be done by a combined Lowe. He (Mr. Jolliffe) was looking forward, with some interest, to an installation of water gas; and he was naturally anxious to get all the information possible.

Mr. BERTRAM B. WALLER (London) said the ground had been so ably covered by Mr. Carter's brilliant oration that he had left very little in the way of discussable points. The cost of purification was an item he was also interested in; Mr. Brockway's figure being the least cost for purification that he (Mr. Waller) had ever come across in his experience. It would be exceedingly interesting if the author could give the members a reason for the figure being so low as the one he mentioned. With regard to the oil and coke consumption, he could only confirm what Mr. Jolliffe had said, that the figures in the paper were quite approximate to the consumption of oil and coke in the average Lowe carburetted water-gas plant. Good working results would show from 7·8 to a little over 8 candles per gallon of oil, and with coke as low as 30 lbs. or under in the generator, or a total of 34 to 35 lbs. inclusive. With others who had entered into the discussion, he entirely failed to see how the dual plant would reduce the item of labour, or that it would create any economy in the working of such a plant. Of course, the heat required to gasify the oil in the Peebles process simply corresponded to the gases used in the Lowe plant to heat up the chequer brickwork for gasifying the oil. Where the saving or economy came in of this plant over the other, at the present time he did not see.

Mr. R. G. SHADBOLT (Grantham) wished to say a few words from the point of view of one who, at some remote period, might possibly be called upon to decide upon the merits and demerits of these respective plants and methods. Approaching the subject from this point of view, and not being immediately interested, the first thing that struck him, in reading the paper, was one of the reasons that Mr. Brockway gave for having selected this combination in preference to a plant of the Lowe type—that was the ease with which he could produce either blue water gas, carburetted water gas of any desired candle power, or, if necessary, oil gas alone. Certainly on the face of it, to one who was not accustomed to working it, it did look as though, with the Lowe plant, one was wedded to one method of working, and one method alone. There was another point which had not been touched upon by the speakers, but which had been hinted at and referred to by the writer of the paper, and that was what they heard so much about at the present time as to the greatly increased volume of gas to be obtained by the conjunction of the blue water gas and the nascent coal gas as evolved in the coal-gas retorts. Unfortunately for their discussion, Mr. Brockway had not got so far as the carrying out of experiments on this particular line; and it was a duty which he owed to himself, and a privilege which the members of their Association might claim, and it was certainly a duty to the gas industry at large, that he should not rest content after his present effort, but that on some future occasion he should come forward with his paper completed—not merely with an addendum, but with his present figures confirmed, if they were confirmed, and with the addition of the results—which to his (Mr. Shadbolt's) mind would be the most interesting of the whole question—that he obtained by the introduction of the blue water gas into the coal-gas retorts. If there was one advantage which this combination had over the Lowe system, it was to be found in the readiness with which the blue water gas could be introduced into the coal-gas retorts on what was known as the Lewes process, so that they might obtain

thereby an increased volume of gas and an increased total calorific value. There was another reason why, in Mr. Brockway's own interests, they ought to have a further paper, or a continuation of this one, and that was the shortness of the present tests. These, he took it, had been practically confirmed in the aggregate over the working during the period that Mr. Brockway had used his plant; but still, it would be more satisfactory for him, and for them all, if he made an extended test of several weeks' or months' duration, and gave the exact results. Though he (Mr. Shadbolt) did not agree with everything that Mr. Carter said, he usually agreed with a great deal; but he fell foul of him in one part of his speech. Mr. Carter, with that inimitable manner and sweep of the hand of his (laughter), seemed to put aside all those benighted individuals who continued to make coal gas alone, when he said that the question of Coal Gas *v.* Carburetted Water Gas had been once and for all disposed of. The question, Mr. Carter said, was not now whether carburetted water gas was cheaper than coal gas, but whether one system of manufacturing carburetted water gas was cheaper than another or not. He (Mr. Shadbolt) ventured to disagree with Mr. Carter to a slight degree. He must be off with the old love before he took on with the new. Coal gas, at even the Lincoln works, was the staple output; and Mr. Carter had himself told them on more than one occasion that they must never look upon carburetted water gas as anything more than an auxiliary or as an assistant. In fact, to be consistent, if there was this great difference in the cost of coal gas and carburetted water gas that Mr. Carter had mentioned that there was, then they ought to move heaven and earth to get legislative sanction to allow them to send out alone carburetted water gas as far as they were able to do so. But the cheapest gas in the world, as they were all well aware (he did not say in what country, or whether it was in England or Scotland), was made from coal. That, however, was not the question. To his mind, interest had been revived in the question by this one thing to which he had referred—that was, the almost mysterious increase in the volume of gas to be obtained by the manipulation of the blue water gas and the coal gas. This was at the present moment one of the most interesting features of water gas manufacture; and this was he thought, if anywhere, where Mr. Brockway's plant scored—in its adaptability to a system like the one referred to. If they took the Lowe system, they blew up the fuel in the generator, and sent off a certain proportion of the gases (which contained a lot of carbonic oxide) into the carburettor and superheater, and utilized these gases for cracking up the oil. The coke used in this way to heat up the superheater, and the coke used by Mr. Brockway under his oil-gas retorts, were very little different. Undoubtedly, however, in the manufacture of "straight" water gas as the Americans called it, or blue water gas as it was called here, and the introduction of it into the coal-gas retorts (without any such great reduction of illuminating power as would be imagined by a plain mixture of the kind), and then the manufacture of oil gas alone, and the introduction of the necessary portion of the oil gas afterwards into the mixture to bring it up to the requisite standard of illuminating power, there must be a saving effected there, as Lewes, Stephenson, Brown, Brockway, and others had told them. They had here the advantage of separating the various portions of the plant and manipulating them in any fashion they liked. Mr. Carter had said that they wanted facts; but the difficulty was to get facts that were not vitiated by some extraneous circumstance or other. Mr. Carter said they ought to have figures from actual working under the different conditions where the water-gas plant was used as an isolated unit. Well they all of them knew that, if any one had such an ideal plant at his command, that was Mr. Carter. He would render no small service in the present controversy if he would give them the facts from his own actual work, which ran over a considerable period; and then get another engineer—Mr. Brockway or someone else—to give them the facts from his isolated plant where the operations were split up part into blue water gas and part into something else. In this way, they would have the best of comparisons, at which no one on either side could cavil. As to the tables which Mr. Brockway gave at the end of his paper, he had tried to run the figures out to the costs per 16-candle power. In the first table in the appendix, the author gave coal gas alone as 15·5d. per 1000 cubic feet; and the illuminating power as 15·85 candles. Going on to Table II. he would suggest to Mr. Brockway that the table he previously gave as to the cost of 16½-candle carburetted water gas ought really to be Table II. to be in order. Then they would see where the mixtures came in. Then the present Table II. would become Table III. This referred to coal gas *plus* blue water gas in the foul main; and there the 14·94-candle gas cost 12·5d. Then Table III. would become Table IV. There the mixed gas of 16·66 candles cost 13·1d. Then they wanted another table giving the figures for the blue water gas and the nascent coal gas mixed and carburetted up to the necessary illuminating power afterwards; and this would give them the figures complete. The present figures were not quite comparable because the illuminating power was different; and so he had worked out the figures to 16-candle power. This conversion would make the cost for 16-candle power coal gas 15·68d.; for 16-candle coal gas, *plus* blue water gas in the foul main, 13·28d.; and for coal gas *plus* carburetted water gas 12·48d., which really showed, if anything, a greater difference in favour of the coal gas and carburetted water gas mixture made under the Cleethorpes plan than Mr. Brockway showed himself. There was nothing very much in the point; but the figures were not exactly on a comparable basis. There was one prominent point about it all, that if they took coal gas alone and the carburetted water gas alone, and in the proportions of about 50 per cent. (he thought Mr. Brockway took them at that percentage), they got to the figure of 12·5d. per 1000 cubic feet; so that Mr. Brockway was getting no advantage, on the point of cost, in his mixture of carburetted water gas and ordinary coal gas; but if they took his other statement—the introduction of the blue water gas into the foul main—they got a distinct saving. This was the one thing which had given interest to this question at the present time, and which question gas engineers would like to see threshed out. If they could point to a distinct gain on the ordinary mixture of carburetted water gas and coal gas, then certainly it was a step in the right direction, if only to the extent of a fraction of 1d. per 1000 cubic feet.

Mr. CARTER said he would respond at once to Mr. Shadbolt's request. He did not give his own figures for this reason, that he was making at Lincoln 18-candle carburetted water gas; and the cost for the last three months into the holder worked out to exactly 10d. per 1000 cubic feet. The members would see that Mr. Brockway's figures were 9·62d. for 16½-candle gas. He daresay that, taking into consideration the fact that he (Mr. Carter) had carriage to pay on his oil from port to Lincoln, would account for the difference in the manufacturing cost of the gas, as he was making it, of 18-candle power as against 16½-candle power. His average oil efficiency during the three months was 7·8 candles per gallon.

Mr. BROCKWAY: Does the 10d. include management and wear and tear as well?

Mr. CARTER: Yes, it includes that, Mr. Brockway; and I debit in my calculation about four times your charge for purification.

Mr. BROCKWAY, in reply, stated that it was only under pressure by the Committee that he had consented to read a paper on this subject at the present meeting, as he had had the plant in operation for so short a period. With regard to Mr. Carter's first point, as to the investigations he (Mr. Brockway) had made before adopting this plant, he obtained all the returns he could on the subject, and made a large number of inquiries; and the result was as stated—that he could not expect to make carburetted water gas by the Lowe system any cheaper than he was making his coal gas. As regarded a detached statement, his plant was not detached, as was explained in the paper. Respecting the purification charges, Mr. Carter and some other gentlemen present would be equally surprised when he told them that, for months past now, the purification of the coal gas at Cleethorpes had not exceeded 0·16d. per 1000 cubic feet. The method by which he arrived at the cost of the purification of the water-gas was in this way: The oxide, of course, was in the trucks, and the wages were taken for filling the purifiers (four purifiers, 10 feet square, which had been discarded for coal gas, and which he had put into use for the water gas), then the quantity of gas passed through before the first one fouled, the labour in emptying the box, and so on right through the four purifiers. He took the cost of the whole, and divided the amount by the quantity of gas passed. So that there was not by any means any guesswork about this; the figure given was the absolute wages paid in the purification of the quantity of gas passed. Mr. Carter also said something about comparing one's best results with the worst ones found in another plant. In the paper he had not compared his results with anybody's. He left members and others who might be sufficiently interested to read the paper to do that on their own account. He thought Mr. Shadbolt had answered Mr. Jolliffe's question as to why he adopted this dual plant. He considered it gave him such a variety and range of working, that he could make blue water gas and use it as he liked. He was anxious, too, to test Professor Lewes's system; and, in addition, he could make either carburetted water gas or oil gas alone. Further, he believed he should get better results from the oil by using the Peebles process; for the reason that, in this process, they kept the retorts to just the proper temperature to obtain the best results from the oil, and this temperature could be maintained through a whole twenty-four hours' working. In the Lowe process, when the blow finished, they got rather a high temperature—just a little too high for the perfect gasification of the oils; and towards the end of the run, they must get the temperature a bit too low, and then a little tar was made. Therefore, the advantage of the Peebles process was that the oil was always gasified at the most even temperature, and in the most regular way; and there was no tar. In this dual process, the only important residual was a good hard coke; and he found there was an increasing demand for it. He was now getting £1 a ton for it, and he had just received an offer of 22s. 6d. a ton for all he could make. As regarded the tables at the end of the paper, the hurried manner in which the paper had been written would explain why they had not been placed in such consecutive order as might be desired. He was quite aware that experimental runs and tests of short duration must not be taken to indicate correctly the working cost on an average and all-round scale. The balance-sheet and the accounts would show this accurately. He was quite satisfied to leave it so. All the results would be in his balance-sheet; and he was convinced that, by this process, he would send out the total quantity of carburetted water gas and coal gas at a reduction of 3d. to 4d. per 1000 cubic feet on what it was costing him now for making coal gas alone.

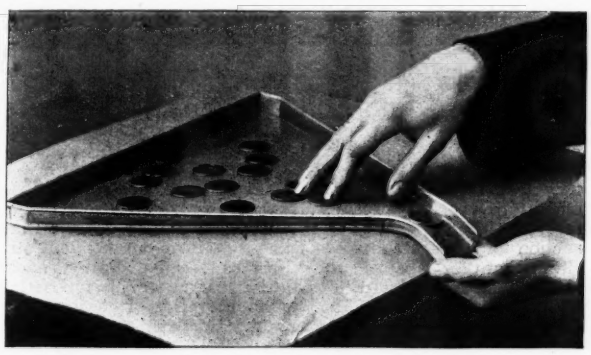
FACILITATING THE COLLECTION AND COUNTING OF COIN FROM PREPAYMENT METERS.

By H. Wimhurst, of Sleaford.

[A Paper read before the Eastern Counties Gas Managers' Association, April 22.]

I wish to-day to introduce to your notice a ready means for the collection and counting of the coin from prepayment meters. Our business in this connection having increased to such dimensions that a more ready way of handling the coin and facilitating the collection has become imperative upon most gas undertakings, the writer, having this part of his Company's business under his control and management, has devised means to attain this object.

Some three years since, the writer found that to bring the immense quantity of coppers from the consumers' meters to the offices (which are at the extreme end of the district supplied) was too much of a tax upon the strength and endurance of even the strongest of collectors or labourers, and took up too much of the collectors' time. To overcome this difficulty, a coin conveyance was designed, and the order placed with a certain firm of meter manufacturers to make it. I have no doubt it is well known and greatly appreciated by many of you, as I am given to understand that numerous orders have been received from gas engineers for these conveyances. To those who may be in ignorance of its worth, I may here state that the conveyance is of the best material and workmanship, the wheels of the bicycle type—cushion rubber tyres and ball bearings—mounted on springs, the body made of the best pine, painted and finished in Post Office red, so that it may be readily recognized, and lettered in gold to order. With this conveyance we send a lad and two collectors. These, as a rule (over a straggling district), can clear 150 meters per day of eight hours; and the coin is brought to the office at the dinner hour and close of the day, with very little effort on the part of the lad or collectors—in fact, the last-named now say that it is quite a pleasurable occupation in comparison with what it was previous to the adoption of the coin conveyance. I may add that it is made perfectly strong, though very light-running, and is often used by the writer to send as much as £60 worth of coppers to the bank at one time.



The Coin-Counting Tray Designed by Mr. Wimhurst.

In use, the money is not counted into the hand as shown in photograph, but into a bag made to hold 5s. worth of pence.)

When you have emptied your meters of their contents, a greater difficulty often than the want of a conveyance is how and where to count the coin and bag it in the usual 5s. packets. Some consumers, from circumstances, have very little accommodation for this part of the collectors' duties, and no doubt you have all found that the poorest furnished house is often the best consumer, and therefore has the most coin in the meter to be dealt with by the collector. Having had a good deal of experience upon this point during the last decade, I have carefully thought this matter over time after time, and have designed and had made the coin-counting tray I now introduce to your notice. I have had this made in aluminium, of sufficient strength to withstand all the rough usage such an article is likely to be subjected to, and of a large enough size to deal with the whole contents of any one meter at one time. You will observe that the tray is so designed that its shape readily lends itself to the correct discharge of the coins from the surface of the tray to the bag into which the pennies or silver coins have to be packed. You will find that the angle at which the discharge end of the tray is set is an important point for the correct and perfect manner in which the coins can be quickly passed into the bag. The sides of the tray and the form of its make are also very important features. This coin-tray has pockets on the under side with rubber pads to prevent slipping—a most desirable feature for perfect working. It can be used at the consumer's house, on his best mahogany table, in his cellar, or on any form of bench that he may have at his command, or, if in a more unfortunate household, on any window-sill, chair, form, or other slightly elevated position, or even, as in the writer's own case, used in the office, upon the counter. The coin-tray the writer considers a most useful adjunct to any office or bank where large numbers of coins have to be counted; the saving in time being quite as 3 to 1 in favour of the tray over the usual system of counting off a table or counter top. The coin-tray has been lent to two or three gas engineers, who speak very highly of its capabilities and usefulness.

Discussion.

The President (Mr. E. W. Smith) said he did not expect there would be such a lengthy discussion on a paper of this nature, as they had had on the two previous ones; and he did not suppose that Mr. Wimhurst anticipated there would be. The paper simply brought before the notice of the members a useful contrivance for lessening the work of counting coins from prepayment meters, which was becoming with gas undertakings such an important question.

Mr. R. G. Shadbolt (Grantham) said he could quite understand that a tray of this kind would be extremely useful on a counter, or in any position of that kind. But it occurred to him whether it was not a source of error, or at any rate of confusion. If a man did not take out of a meter exactly 5s. of coppers, he would have a number over which he must carry in his head—or rather to the next house, until he got sufficient for another 5s. He could quite appreciate the value of the tray on a counter.

Mr. J. H. Troughton (Newmarket) said he had to deal with a large quantity of coppers, and he noticed that Mr. Wimhurst said he sent out in connection with his coin-cart two collectors and a boy. He should like to ask how the two collectors worked. Did they have separate receipt books, or did Mr. Wimhurst not give a receipt? In his own case, they gave every customer a receipt for the amount of money taken out of the box. If two collectors went out together, there must be a certain amount of confusion in regard to the books which they had to sign. He had often thought he would put this question before the Association, with the view of getting the members to say whether it was usual or not to give receipts to slot consumers. He thought it was the right thing to do; but he had heard it was not a plan usually adopted.

Mr. C. F. Ruggles (Leighton Buzzard) asked Mr. Wimhurst whether he could tell the members what it cost him to do his collection, seeing that he sent out three collectors, and how much money was collected per day by each man. At Leighton Buzzard, they had 680 meters; and his one man collected an average of £16 2s. 8d. a day. In the year, the amount collected was £1640; and it cost him £24 18s. 8d. to collect. It seemed to him that to send out three men was a big expense. His man came in twice a day; and the money was counted up, put into packets, and sent to the bank. According to a stipulation made with the bank, the Company had to roll the coppers up into packets, and send in £60 worth of packets each time.

Mr. J. T. Jolliffe (Ipswich) said he should like to ask Mr. Wimhurst if he found much difficulty in disposing of his coppers, and how he got rid of them. Perhaps it would be interesting to the members if he told them what they did in Ipswich in the matter of collecting, and what it cost. They had several thousand slot meters fixed now; and the total amount collected last year from them was £13,761, or an average from each meter of 4s. 1½d. per month. They collected monthly, and paid the men by piecework, at the rate of ¾d. per meter per collection. The duties of the men were: To read and record the state of the index; to empty the cash-box, and record the amount; to collect oven-rent, and give a receipt; and to report complaints and changes of tenancy. The men were paid an additional ¼d. per pound for counting and bagging the coppers in 5s. packets, which were then ready for exchange. As they had three collectors, they had three different coloured bags, in order to locate any errors. The cost of collection and bagging worked out to 0·7d. per 1000 cubic feet. Each collector was supplied with a strongly made bicycle, with a leather bag attached to it. They were able to collect from 150 meters a day; and each collector's daily average over the year might be taken as about 100.

Mr. E. J. Brockway (Cleethorpes): 150 meters per day by each collector?

Mr. Jolliffe: Yes.

Mr. Wimhurst, in reply, said, in answer to Mr. Shadbolt, that supposing there happened to be 17s. 7d. in a meter, the odd 2s. 7d. would be put into the collector's bag; and he had to enter into his book the total amount collected from a meter. When he had a sufficient amount of the odd pence, he would make up another 5s. ready for the bank. As to Mr. Troughton's remarks, the only receipt they gave at Sleaford was the gas they supplied to the slot consumers. They gave a receipt to those who had cookers on hire at 9d. or 1s. per quarter; but they gave no receipt for money taken from the meters. Regarding Mr. Ruggles, he might say that the two collectors got in about £60 or £70 a day. He did not quite understand whether Mr. Ruggles meant that his collection cost him £24 per annum. [Mr. Ruggles: Yes.] In his own case, he did it for less than half that amount—about £10 or £12. The coins were brought to the office and counted there. He must congratulate Mr. Jolliffe upon the exceedingly efficient service rendered by his coin-meter collectors. He said they collected 150 meters per day. The meters must be very close together—closer than in his own case. His district was rather straggling. He reckoned he had a rather smart ordinary

meter-taker, and he found it a difficult job for him to get through 100 ordinary meters a day. It was a smart piece of work for collectors to clear 150 meters a day. Both the collectors at Sleaford had books. They worked in the same district—one taking one side of the street, the second one the other, and the boy looked after the coin conveyance. Each meter was emptied separately into a canvas bag; the register of the meter, and the number of the consumer was put into the bag with the coins; and the counting was carried on at the office during the period of collection. His idea chiefly in designing the tray was to enable the coins to be counted at the houses more readily than they could be under existing circumstances.

PROGRESS IN INCANDESCENT GAS LIGHTING.

The following is an abstract translation of a recent communication by Herr E. Schilling to the "Journal für Gasbeleuchtung" on the illuminating duty obtainable from gas by the aid of modern mantles:—

The osmium lamp has provided the electrical industry with a fresh means of competing with gas. It is therefore worth while making a comparison with the results shown by the best incandescent gas-light mantles at present in use, particularly as there has recently appeared on the market a mantle, the brilliancy of which increases for a certain time, whereas the older mantles and the incandescent electric light show a constant decrease in lighting power. The following measurements refer to (1) ordinary Welsbach mantles, (2) "Degea" mantles, and (3) "Gem" Welsbach mantles:—

Hours Burning.	Candle Power.			Candles per Cubic Foot of Gas Consumed.		
	(1)	(2)	(3)	(1)	(2)	(3)
—	107·0	70·60	38·00	27·91	18·30	18·30
48	82·0	68·80	33·00	21·20	17·70	15·70
96	74·0	84·70	31·00	19·10	21·80	15·00
168	72·0	83·30	28·50	18·80	21·40	13·40
337	66·2	95·60	28·59	17·00	24·81	13·50
385	65·2	92·60	22·80	16·80	23·90	10·80

The cost of burning the 32 Hefner (28-candle power) osmium lamp amounts to 1·13d. per 100 Hefner hours. Taking the burning life of an incandescent gas mantle at 500 hours, the mean intensity (according to the foregoing experiments), at 81·6 candle power, and the price of gas at 5s. 8d. per 1000 cubic feet, the cost for 100 Hefner-hours, inclusive of the consumption of mantles, will come out at ⅛d. The proper regulation of the gas consumption plays so important a part in the utilization of the energy of the gas, that Herr Schilling most strongly recommends the use of governers before the burners.

SOUTH-EAST OF IRELAND GAS ASSOCIATION.

The Third Meeting of this Association, the formation of which was recorded in the "JOURNAL" for the 17th of February (p. 413), was held at the Kilkenny Gas-Works on the 16th inst., under the presidency of Mr. R. Bruce Anderson. There were ten members present. After an inspection of the works generally, and particularly of a holder in course of being telescoped, Mr. J. Richmond, the Manager, entertained the members to dinner.

The business opened with an announcement by Mr. J. G. Tooms (Waterford) of the receipt by him, on behalf of the Association, of a present of 15 technical books from an anonymous donor, to form the nucleus of a lending library; and the Secretary (Mr. G. Lennon, of Dungarvan) was instructed to convey, through Mr. Tooms, the Association's thanks to the donor.

Mr. J. Paterson (Tipperary) then read a paper on "Stokers and Stoking in Small Works." He emphasized first the necessity of having well-designed furnaces and settings, erected by a thoroughly competent setter, and then insisted upon employing good stokers and supervising their work well. He animadverted upon the practice of having "handy" men or local bricklayers to erect settings, as causing more anxiety to the manager than was compensated for by the cash saving arising from the cheaper labour. For works making less than 25 million cubic feet of gas per annum he advocated shovel charging; preferring to work men in pairs for the speedy charging of retorts. Both men would charge into the same retort at once—one trimming the charge with the rake while the other fetched the lid. He advocated an occasional word of encouragement to the men, when merited, in addition to firm rebuke where this was deserved. He had tried a bonus system with his men—paying all of them 1½d. per 1000 cubic feet for all gas made per man per day in excess of 15,000 feet. It worked admirably so long as the make per man increased; but when, in the spring, it necessarily fell off, the system was naturally unpopular, and he accordingly abandoned it. In view, however, of the great improvement in working generally which had resulted, he had compensated his men by a permanent rise. Thus he did not look upon his trial of the bonus system as a failure, as it had caused the men to educate themselves up to a better standard. During the past twelve months he had managed to obtain yields of 6000 to 6500 cubic feet per mouthpiece—fully 10,000 feet per ton—from Durham coal, and to sell 9½ cwt. of coke per ton of coal used.

A discussion followed, in which, in accordance with the Association's exceptional regulations, every member took part. The President said he preferred scoop charging wherever two men were available; and he was not in favour of too rapidly closing the retorts after charging, because of dust from the coal causing stopped pipes. Mr. Richmond advocated shovel charging with rubbly coal, but preferred scoop for slack. Mr. Tyndall (Carrick-on-Suir) preferred shovel charging for even large works—like at Widnes, where only slack is used and is all charged by shovel. Mr. G. W. Norman (Dublin) considered bonus systems very apt to lead to discontent. Mr. Tooms, while recognizing the importance of great attention being paid to the retort-house, feared many managers spent much time there which might with advantage be devoted to the district and to looking after one's customers. He considered that if properly supervised, any competent bricklayer should be able to satisfactorily set retorts. He favoured shovel charging, because of the disorganization of a gang when substitutes had to be put in for men away on the sick-list. He advocated consistent treatment of the men, but was averse to anything like pampering. Mr. A. Kirkham (Tramore) found it difficult to get men to charge well with shovels, and would prefer scoops wherever possible. Mr. Jer. Grant (Fermoy) believed in having a trained retort-setter rather than saving by employing a man unaccustomed to such work. He preferred to pay stokers thoroughly good wages, and then make them work, to any bonus systems, all of which he thought were dangerous. Mr. Lennon found difficulty in pairing shovel chargers, as so few men were left-handed. Mr. Paterson, in reply, insisted upon all his points. He said he had not been unduly troubled with stopped pipes, had no difficulty in getting even charges by means of the shovel, and would always use a trained retort-setter whenever obtainable.

The next paper was by Mr. Kirkham, and was entitled: "Notes taken in a Small Gas-Works." It was written in a humorously light vein, and consisted chiefly of reflections caused by some remarks made by one of the writer's Committee, who did not profess to know anything about gas making. The writer commented upon the great difficulty he found in placing cookers, in consequence of their not affording the necessary supply of hot water.

The paper gave rise to a very good discussion. The President asked for expressions of opinion from any members who had had experience in using Lyon's syphons, which he said he had been reluctant to employ on account of the trap he feared they would prove for naphthalene, and the obstruction they offered to the flow of gas. He suggested, as an alternative, forming dips in the mains by means of a pair of swan-necks; the suction and two stand-pipes being run to a box conveniently situated at the roadside, so that leakage-testing operations could be conducted without disturbing the road or unduly interfering with the traffic. Mr. Tyndall found the price of gas militated against its use for water heating, and also that Lyon's syphons collected naphthalene. Mr. W. Paterson (Bagnalstown) described a water-heater which could be adapted to any gas-cooker. Mr. Grant felt the great want of assistance in testing mains which would result from the use of district valves or Lyon's syphons. Mr. J. Paterson favoured the double swan-neck dips for testing leakage. Mr. Kirkham briefly replied.

It was decided to hold the next meeting in about three months' time at Dungarvan.

The meeting then concluded, and visits were paid to Kilkenny Castle and to St. Canice's Cathedral and the Round Tower. The members then returned to the works, where Miss Richmond served tea. After cordially thanking their genial host and his sister, the members left for their various destinations.

The Informal Meeting of Scottish Gas Managers.—Mr. W. B. M'Lusky, the Chairman at this meeting, the proceedings at which were reported in the "JOURNAL" last week, asks us to correct some inaccuracies in the figures relating to manufacturing wages which he quoted in his reply on the discussion (p. 153). He cited Colne and West Bromwich as examples of excellent working with West's manual machines; the wages at these places being respectively 2·405d. and 2·665d. (not 6·65d. as given). Mr. M'Lusky explains that he instanced Carlisle as showing what was still attainable with hand labour, the manufacturing wages in the city working out to 3·64d. At Perth, with West's manual machines, they amounted to 2·964d. (not 2·09d.) last year.

The Law Relating to Employers' Liability and Workmen's Compensation.—We have received from Messrs. Butterworth and Co. the sixth edition of Ruegg's "Employers' Liability and Workmen's Compensation," and the eighth edition of Willis's "Workmen's Compensation Acts, 1897 and 1900." The new feature of the former work is the incorporation of the decisions by the Courts of Appeal in England, Scotland, and Ireland, both upon the Employers' Liability Act, 1880, and the Workmen's Compensation Acts, 1897 and 1900. Mr. Willis believes that the new edition of his little book will be found to contain a reference to every reported case, as well as to a few others not reported, decided in the Appellate and High Courts of England, the Court of Session of Scotland, and the Court of Appeal of Ireland. These number altogether some 278 decisions.

IS THE ZIGZAG FLUE NECESSARY FOR HEATING SECONDARY AIR?

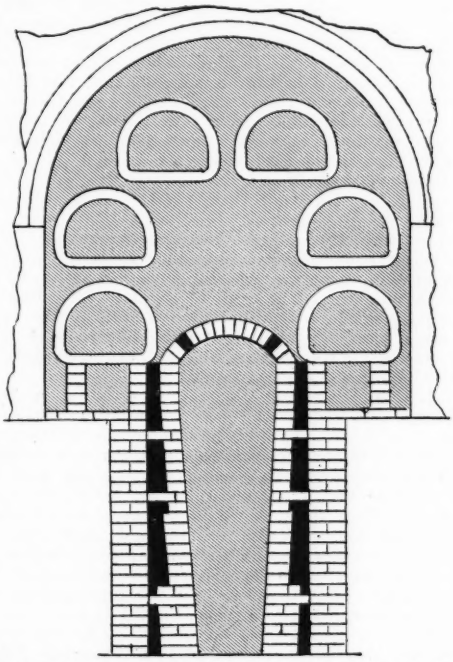
By J. Whyte, of Seaham Harbour.

[A Paper read before the North of England Gas Managers' Association, Saturday, April 25.]

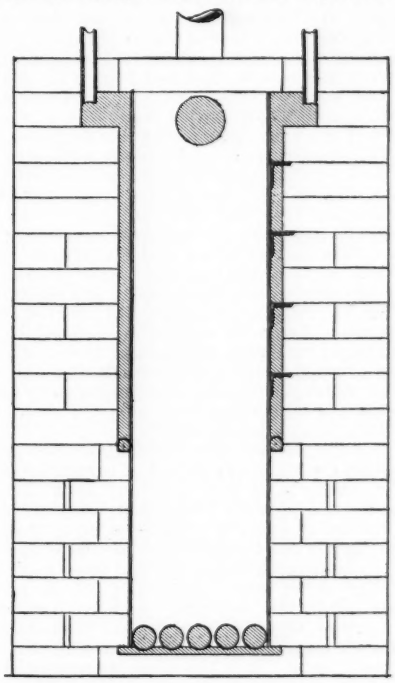
In bringing before you the following notes on secondary air heating, I know I am treading upon very delicate ground, as my experience does not confirm what, so far as I know, is the general method of heating secondary air for generator furnaces. I speak of these only, as I have had no experience whatever with regenerative furnaces. I know I am in good company with such men as Mr. Charles Carpenter and Mr. Valon in believing that air may have its temperature very materially increased although only a short time in contact with the hot brickwork. Some seventeen years ago, I employed a well-known firm to put in three beds of six retorts on the generator principle. Though assured that excellent results were obtained elsewhere from the same patent settings, I must say in our case the results were very disappointing. I do not lay the blame on the settings themselves, or their principle; the fault may have been ours. Be that as it may, the settings, which were to do such good work and with trifling cost for repairs, &c., soon showed certain weak spots in construction and working, as the whole of the brickwork in front of the furnaces was burnt away in three months and required renewal.

When renewing the retorts afterwards, we made certain alterations, which considerably modified the wear and tear of the furnaces; but our make of gas was still very disappointing. I may explain that, as originally set, the secondary air had a zigzag flue, giving it, roughly speaking, some 20 feet of travel before entering the furnaces. After carefully considering the matter, I concluded that the idea of giving a long travel, so as to keep the air as long as possible in contact with the hot brickwork, was the correct one, but thought I could improve matters by leading the air-flues round the back of the furnace with only a 4½-inch brick separating the two air-courses—giving some 4 feet longer travel on each side. After a time, we got up the requisite temperature, but with a greater consumption of coke. The conclusion I then arrived at was that the extra travel and sharp corners at the back of the furnaces meant extra pull of the chimney, which would tend to draw the heat too quickly from the retorts; hence the increased fuel. My next step in renewing these settings was a retrograde one. I not only cut off the flue at the back of the furnace, but also two of the side flues, which reduced the travel of the air to something like 14 feet. I found our heats as good, and the consumption of coke slightly less. I afterwards reduced the travel to about 9 feet, with just as good results. Since then, I have dispensed entirely with the flues—simply passing the air into a cavity behind the furnace casing and allowing it to travel slowly upwards in contact with the hot brickwork.

My object in bringing this matter before you is to endeavour to get the benefit of the large and mature experience of some of our members, who have given so much time and consideration to



Section of Oven, showing Producer and Air-Flues.



Section of Experimental Producer.

the heating of secondary air. I know that theoretically I am wrong; but practically I think I am right in saying that I can get the air hotter by the latter method. I may say further that what strengthened my opinion and induced me to bring the subject before you now was the results of some experiments I made three years ago. These results perfectly astonished me; and even now I cannot account for them. I had a man setting some retorts for me with a very large experience in this class of work, having set thousands of them in all parts of the kingdom. While quite willing to set them to my idea, with the open space behind the sides of the furnace lining, yet he considered I was making a great mistake in so doing. His argument was that a long travel against the hot brickwork for the air was bound to give better results. He pleaded very hard to be allowed to put in one setting to his own idea.

We argued the matter time after time, but got no nearer a settlement until we agreed to build a small experimental furnace of sheet iron, the internal dimensions of which were 12 in. by 12 in. and 4 feet high. On one side we left an open space, and on the other we riveted four pieces of 2-inch angle-iron, corresponding to the zigzag flues. He built the brickwork, and every care was taken that the thing should have a fair trial without prejudice either way. I had two pieces of ¾-inch wrought-iron tube cut exactly the same length (10 inches), both fixed at the same level—viz., 30 inches from the top for inlets for air. The outlets were 1-inch pipes, both of the same length; and a Fahrenheit thermometer was hung in each by means of a disc of rubber insertion with a hole in it, through which the thermometer stalk was passed. These discs rested upon the pipe ends, which were serrated to allow the heated air to escape. All being in order, a fire was lit; and the following results were indicated by the thermometer:—

First test	with	open	cavity	65°,	with	flues	58°; difference 7°
Second	,,	,,		167°	,,	118°	,, 49°
Third	,,	,,		220°	,,	179°	,, 41°
Fourth	,,	,,		290°	,,	220°	,, 70°
Fifth	,,	,,		300°	,,	230°	,, 70°
Sixth	,,	,,		290°	,,	208°	,, 82°
Seventh	,,	,,		245°	,,	200°	,, 45°
Eighth	,,	,,		220°	,,	175°	,, 45°
Ninth	,,	,,		245°	,,	205°	,, 40°

We watched carefully the result of each test, which I may say were of from 15 to 20 minutes' duration, made at three different times and on two separate days. The retort-setter felt sure the thermometers were not graduated alike. We changed them, *vice versâ*; but the results were exactly the same—the escaping air from the open side being always of a higher temperature than the other. Even in the end it was a case of "a man convinced against his will," &c.; for he still maintained that, according to all law (his law especially), the air having the longest travel was bound to be the hottest, and that my line of argument was entirely wrong. He could not say where or why, but he seemed to me to be a firm upholder of the maxim, "Believe nothing you hear and only half of what you see."

I readily admit that there is not much advantage in the method I recommend; but there is a saving, as the chimney draught can be reduced, thereby allowing the heat to remain a longer time in the setting. There is likewise a small saving in the first

cost. My only regret was, and still is, that the experiment was not made more complete by measuring the quantity of air passing into each side. With a flame against each inlet, there were indications of a strong pull in both. I think we may reasonably assume the open side must have drawn as much air as, if not more than, the other, notwithstanding the difference in the temperature at the outlets.

One word in conclusion. If I am proved to be right, then I say, "Go and do likewise." If I am wrong, I shall be glad to be corrected, so that I may be saved from practising error and teaching it by my example.

Discussion.

The PRESIDENT said that Mr. Whyte was very anxious that he should get a good discussion upon his paper, and he hoped he might have his wish.

Mr. D. TERRACE (Middlesbrough) said that although he had not given great attention to generator furnaces, he had had a good deal to do with regenerative furnaces, and most members would notice the great difference there was in the arrangement of the flues. But he might say that what Mr. Whyte had now carried out in respect of the single travel, as against the three or four travels, occurred to him many years ago. He believed in the theory, but had not had the opportunity of carrying it out. No doubt if Mr. Whyte had measured the quantity of air going through the left-hand passage, as shown on the experimental diagram, as against the other, he would have found a very great difference in the temperature—he would, at any rate, have had a much greater volume passing through. This, again, would be heat that was being lost, and would account for the difference in temperature. He believed Mr. Whyte was right in his contention, but was sorry that he had only carried it out in an experimental, instead of a practical, stage. He thought Mr. Whyte was going forward, and he complimented him on his paper.

Mr. C. DRU DRURY (Sunderland) did not know that he could bring anything into the discussion, because he was not quite clear about the furnaces that were shown in the diagrams. In Sunderland, they had two old-fashioned retort-houses with direct firing, the expense of turning which into regenerator settings would be very great. In another house, they had a bench of twelve regenerators; but they had only been working for a very short time, so that he could not give any information as to what they were doing. He had no doubt that Mr. Whyte was right to a great extent. A discussion took place some years ago, when Mr. Valon brought forward his theory about the heating of air. He saw that Mr. Herring, in Edinburgh, had adopted very much the same system—a system of vertical pipes, in which the air was allowed to travel vertically, without any baffles at all. The only question was whether the waste heat they obtained from these settings was worth the expense of retaining them for heating the incoming air. In his opinion, it was simply a question of whether they could put in a cheap regenerator.

Mr. W. HARDIE (Tynemouth) certainly agreed—and it was his practice—that the air supply should be carried up straight to the combustion chamber, in the same way as was shown by Mr. Whyte; and while he could quite readily understand that the air could be heated as easily in a flue going straight up like that, in one course, as it could by travelling backwards and forwards, he could not possibly see how the result in these zigzag flues could be worse than in the other. He could not see where the heat Mr. Whyte got in the one case could possibly be lost in the other. In any event, to his mind it must be the same; and, seeing that the air supply had not been measured, this was an item of importance upon which the whole thing rested. Therefore they should be very careful about accepting the statement that the zigzag flue was not so good as the flue on the other side. His own impression was that the flues as shown would be exactly equal. Though he used an upright flue himself, he would be very careful in condemning the zigzag arrangement. He thought an equal result would be got from both.

Mr. H. TOBEY (Malton) said he had used a similar furnace to that which Mr. Whyte had shown, in a setting of six, and he had also used a slightly regenerative furnace, and he did not find very much difference between this and the other. It was probable there was not very much gain in having an elaborate system of regenerator flues, for which they would pay a great deal, and would not get much advantage over an ordinary generator setting. Turn to the other and try the experiment which had been made by Mr. Whyte. Mr. Hardie had said that he thought the difference in the quantity of air passing through the two flues accounted for the difference in the temperature. It appeared to him that in the one which had no zigzag flue, the quantity of air passing through would be very much greater than in the other. There would be a less quantity of air passing through the zigzag flue than on the open side, and therefore he would have expected that the result would have been exactly the reverse of what Mr. Whyte had put it. Of course, such an experiment as this could not be entirely conclusive as to what took place. Unless they measured the air, he did not think they could arrive at any definite conclusion in the matter. He noticed in the "JOURNAL OF GAS LIGHTING" last week that the South Metropolitan Gas Company did not use any regenerative system at all. They made all their gas for heating the furnaces outside the retort-house entirely, and conducted it into the house in flues, and applied it to each setting. This was done to such an extent that the gas actually got cold. It did not go into the furnace hot, but had to be warmed up before it could be used. The Company seemed to be getting very good results. If they could get these results without going to the expense of a subway, he thought they would be doing very well in not spending their money uselessly.

Mr. A. ALLAN (Scarborough) did not know whether the author meant that there was no saving in fuel with a zigzag flue—that was, without any flue at all. He had had some little experience with both regenerative and generator furnaces, and he knew from tests very carefully made, that there was a good saving in fuel with regenerative furnaces, as against generators. In some of the tests he had made with generator furnaces, he found the fuel consumption sometimes up to 23 lbs. of coke per 100 lbs. of coal carbonized; but with regenerators, using the same class of coal, it worked out at about 14 to 16 lbs. of coke per 100 lbs. of coal. With a regenerator setting, using at present a different class of coal, he only required 12 lbs. of coke. He was not quite sure whether the author meant to do away with the heating of the air altogether.

Mr. WHYTE said he did not. He simply passed the air into the furnace casing; and then it went straight up to the furnace, without passing through any zigzag flue at all.

Mr. W. DOIG GIBB (Newcastle) thought that Mr. Whyte was going on right lines when he tried, as far as possible, to simplify the arrangement of flues; and he believed very strongly in the fact that they got better results when they strove after a time-contact between the air and the hot walls of the flues, rather than for a rushing action along the passages. This applied both to the air and to the heat which they brought to the retorts. He thought that a great mistake was often made by many people in restricting the various flues, and in shutting their dampers, so that they got what they called a rushing heat. No doubt, it looked very pretty, in taking a man round the works who was not an expert. It appeared as if they were very busy, and were getting something extraordinary. But there was no doubt that the lower they could get the draught down in their flues, and the slower they could work off the air through the air passages or flues, and the combustion through the settings generally, the better the results they would obtain. He had seen the settings which were referred to—Mr. Charles Carpenter's settings at the Old Kent Road—and there was no doubt that they were doing good work; but he thought a word of caution would not be out of place. The system was not applicable to small works, because they could only operate the outside generator in an economical way when they were running the full house which the generator was built to supply. Therefore they must have such a business as would allow it to be applied to retorts in very large sections; otherwise they would have to run a large producer outside the house to heat half or quarter of the settings inside which it was built to supply.

Mr. J. HOLLIDAY (Hull) thought the question put to them by Mr. Whyte was whether a zigzag flue was necessary to attain a certain result. Mr. Whyte said he could do it in a simpler way. He took it that the whole object of regenerative firing was to practically strip, as far as possible, the outgoing gases of all the units of heat they contained. If they could do this without elaborating their flues, it would certainly be of considerable advantage to them. There was no doubt about that. But they must have a certain number of tests to prove whether they were getting the same results as Mr. Whyte had, against the zigzag arrangement. Then there was the other point that, in the zigzag arrangement, unless they had absolutely perfect construction it was impossible to get perfect results. This was probably the reason for Mr. Whyte having had his trouble. The question came to be whether it was necessary to have elaborate flues in order to obtain good results, or whether they could get the same results with an arrangement such as Mr. Whyte had.

The PRESIDENT joined with the other speakers in thanking Mr. Whyte for the trouble he had taken in coming forward with his paper. Unfortunately, the discussion had got more on to the question of generator *versus* regenerative furnaces, instead of whether it was better to have a chamber only to heat the secondary air in flues, or a zigzag arrangement. Mr. Whyte seemed to be of opinion that he would require more draught with the latter than with a chamber arrangement. It so happened that at the Willington Quay works, which the members visited six months ago, there were both. There was a zigzag furnace having about 50 feet of travel, and there were also upright flues. He might say that the upright arrangement was not absolutely a chamber. It was practically three chambers. The first was at the front, and the second chamber was led from the front, as well as the third. They were all divided by $4\frac{1}{2}$-inch brickwork. Having had some experiments made in regard to the draught in these flues, he found that they were practically the same in every way, both as regarded the temperature of the waste gas and that of the secondary air before it entered the combustion chamber, and also the draught. Roughly, he found that the draught in the combustion chamber was about half-a-tenth, and at the inlet of the secondary air it was about $1\frac{8}{10}$, while further on it was about $2\frac{1}{2}$ tenths. He did not think this was excessive. He inferred from his paper that Mr. Whyte seemed to think that he got too much draught—that he had to put on too much draught to work with the zigzag flues. He did not know what was the size of Mr. Whyte's zigzag flues. But it seemed to him, from the experiments which he had quoted, that there was no

more draught required with the zigzag flue than with the chamber system; and he did not see why there should be—provided, of course, that the flues were of sufficient area. It seemed to him that possibly why Mr. Whyte did not get the results he expected with the zigzag flues was that probably his flues were too small to admit of the proper quantity of secondary air with a reasonable amount of draught. As regarded the question of generators *versus* regenerators, though it was outside the paper, he might say that for the past two years he had used a regenerative furnace at Willington Quay, which he had made extra deep, so as to give greater length of travel. The coke sold the year before last was 11·20 cwt. per ton of coal carbonized; last year it was 11·28 cwt. This was after deducting the producer coke, and also the coke necessary for the boilers. He was afraid that he must go with the side which favoured regenerators as against generators.

Mr. WHYTE, replying to Mr. Terrace, said he had not given them the results of an experiment. He had had the settings he had described at work for seven or eight years, though at the present time he had two or three settings with zigzag flues, in order to try whether he was losing or gaining anything by the system. But at the present moment, he was a firm believer in the open cavity plan. Mr. Hardie might not understand why the results he obtained should be so. He did not understand it himself; and he did not pretend to do so. He simply said these were facts. The man he spoke of was as confident as any man could be as to the flues being right; but he saw that he was wrong. He himself would have been prepared for a small difference in the heats; but he certainly was not ready for the difference brought out. He thought there would be as much air passing through the open flues as there was in the zigzag flues. He certainly believed so himself. Mr. Tobey agreed with him that elaborate flues did not pay. He was a firm believer in that himself. He said distinctly that he had had no experience at all with regenerative settings. He had nothing to say against them; and when the time came for him to renew half his retort-bench, he might go in for regenerators. Mr. Gibb confirmed his opinion that they would get the same results with his system; and if the same results were got, he thought this proved conclusively that the system he had adopted was in the right direction. He thanked the members for the kindly manner in which they had accepted his paper.

THE FUTURE OF GAS.

By E. E. J. ANDERSON, of Middleton.

[A Paper read before the North of England Gas Managers' Association, Saturday, April 25.]

At the present time the gas industry is passing through such a critical period, that I think a few moments devoted to the possible future of gas will be well spent; but it is such a vast subject that I am sure I shall make a very poor attempt to deal with it. I hope, however, my labour may be of some small use to fellow managers. When we see such a large Corporation as that of Manchester fostering the new babe at the expense of the rates, I think we must be prepared with every possible weapon for attack; and up to the present time this has only been done in half-hearted manner. Why, when electrical companies and committees put on two and sometimes more gentlemen of good address to canvass for them, and lay all the advantageous points of electricity before the public, and at the same time mention only the detrimental points of gas, cannot the gas company do the same, and so be able to refute the statements while hot that are made in support of electricity, and at the same time be prepared with the costs of both power gas and electricity compared with the town's supply?

> "Strike with all your might, boys,
> While the iron's red.
> Strike with all your might, boys;
> Hit it on the head."

Turning to power gas, which we have now to face, this is being allowed to gradually get in the thin end of the wedge; and, when too late, gas managers will find that they have two competitors worthy of their steel, and not one as is too often thought. Gas to hold its own must now be sold at such a cost, and of such a calorific value, as to be able to successfully compete with either of the opponents; and managers must also be prepared to hire out not only fires, stoves, and cookers, but engines and other plant that will use their commodity, the same as is being done by electric companies with their motors.

Statements are continually being made about coal gas being more costly than power gas or electricity; but if the absolute calorific value be taken, it must follow that every works needs a calorimeter, which is sure to be required in the near future as a standard means of supply, and the old-fashioned bar photometer will be laid by except for comparison of various lights. It will be found in most instances that gas can hold its own. Gas-engine manufacturers are now making power-gas plant, and, without even inquiring the cost of coal gas, give figures which can never be realized in actual working as to the qualification of their plant, and also the running of their engines much more economically than with the town's supply. These things are at the present time what we have to seriously face; and we must therefore put our house in order, and be prepared with recommendations to our committees to reduce the illuminating power, which in most instances is considerably higher than what we are bound by the various Acts to supply. This, therefore, should not be a great obstacle to overcome.

At Middleton we have had the electric light for twelve months, and the following figures will tend to show what I mean by the Corporation fostering electricity at the expense of the rates. It will be found that as soon as the current is ready, the first thing they do is to light all the public buildings. It certainly is very convenient; but why should the convenience be given to the Corporation officials over any other officers in the town. The total cost of lighting public buildings in the town with gas for the three months ending Dec. 31, 1901, was £18 8s. 3d.; and for the corresponding quarter of this year, with electric light, it was £49 7s. 3d. This will mean, taking the increase over the year, £100, or $\frac{1}{3}$d. on the rates; and at the same time the light is not nearly so effective.

Great strides are being made to improve the current, both in lighting and heating power. I had a test made with a radiator, and the following was the result: Two units raised the temperature from 54° to 60° Fahr., and took two hours to effect the 4°. This was at 2$\frac{1}{2}$d. per unit, or equal to 2$\frac{1}{2}$d. per hour. A register fire placed in the same room raised the temperature 13° in one hour for a consumption of 13 cubic feet of gas, the cost being barely $\frac{1}{4}$d., or one-fifth the cost of electricity for three times the heat in half the time. In other words, for electricity to compete in price, it must be sold at about $\frac{1}{4}$d. per unit.

Lucas and other high-power gas-lamps are now on the market (including Sugg's, "Veritas," and the Welsbach), all of which are effective for lighting large areas; and the lighting cost is very low—a light of as much as 680 candles being obtained for 18 cubic feet of gas per hour. The inverted burners, too, with their small consumption and shadowless light, must be kept well to the front. Some progress has also been made with the self-intensifier, giving a lighting value of 130 candles for 7 cubic feet of gas per hour. It is to these burners that we shall be compelled to look for our consumption in the lighting part; and therefore the more tests we can obtain, and the larger number of good burners that are on the market, the greater is the necessity to bring before our various consumers the merits of each. To enable us to do this, I consider one of the best methods is to hold in the winter months one or two meetings of all the plumbers in the district. I have done this during the past winter; and the effect has been a marked difference in the manner in which the work has been done. Moreover, the feeling between the trade and the gas officials has been more amicable, and greater interest has been taken in gas-fitting.

At one of these meetings, I had various figures of different lights that I had been able to test; also the figures obtained in fitting up a shop with the Lucas lamp. The shop lighting previously was done by six No. 4 incandescent lights. The electricity people were anxious to obtain the shop; so I offered to fit up for three months, free of cost, a Lucas lamp. The following are the actual amounts that the consumer has paid: Quarter, 1901, with six lights, £6 16s.; corresponding quarter this year, £4 10s. 8d. The light evolved was nearly doubled; and so pleased is my customer, that we have received orders to complete the whole of his shop, and also numerous other buildings, including schools, clubs, halls, &c. In another place (a cotton winding mill), we have displaced 86 ordinary burners by three Lucas lamps; and in a large school we have displaced 52 ordinary burners by two Lucas lamps. I just mention this to show that we must accept small mercies rather that be shelved altogether. In street lighting, we have had a Welsbach self-intensified lamp, and also one of Sugg's. These lamps are generally admitted to give a far superior light to the electric arc lamp, and they only cost the town one-fifth the money.

During the month of December, although it was a comparatively light month, and entirely free from fog, we were enabled, through a judicious canvass, to obtain over 200 orders for stoves and cookers. This has been a material help to us; for while our lighting consumption decreased on account of the fine weather, and also the extended use of incandescent burners, our make of gas was maintained through the heating and cooking.

A few figures regarding the way in which the Board of Trade regulate the electric current may be interesting to some of you. One kilowatt equals one Board of Trade unit, and also $\frac{1}{3}$-horse power for engine purposes; while for lighting purposes it equals 32 lamps of 8-candle power lit continuously for one hour. This will give, with current at 4$\frac{1}{2}$d. per unit, 256 candles for one hour, or 57 candles per hour for 1d. Gas for a corresponding period, at 3s. per 1000 cubic feet, will give, with incandescent burners, 840 candles for 1d., or it will need 5$\frac{1}{2}$ burners using gas at the rate of 5 cubic feet per hour and evolving a light equal to 30 candles per cubic foot. These figures show that, for electricity to compete with gas, it must be sold at $\frac{1}{4}$d. per unit; and at present it is impossible to do this, even for constant and very large quantities. Engineers should also turn up at every possible meeting of electric workers, and so show that we are alive to the competition, and only wish it to be done on fair lines. At a meeting I happened to attend some time ago, the lecturer had given some erratic figures and statements regarding gas; and when tackled, he said that if he had known a gas engineer was present he would have been more careful.

Look now at a gentleman's house or shop. You often hear it said, "Oh, yes, your remarks are correct for the time being; but what about the cleaning of the room, and the comfort?" Against this, we can show that in the latter case they are compelled to use more coal to maintain the temperature of the room; and as regards the cleanliness, this is vastly over-estimated. Managers have a great deal to blame themselves for in this matter; for we know how primitive has been the purification in a large number of works, and so caused the sulphurous fumes to affect the decorations of the best rooms. Even in these instances, if the cost be counted, I am sure that the extra amount paid for electricity would far more than settle the bills for decorations.

We now come to the only point we cannot compete with, and that is the handiness; for, whatever we do, we cannot, up to the present time, leave our supply of gas efficiently and safely turned off without some trouble in relighting. But as regards motive power, we can here again leave the electricity in another street; for current supplied at 2d. per unit is equal to gas at 8s. per 1000 cubic feet. This is an almost unheard-of figure; so that we have again the whip-hand, if it is only used in a gentle manner, and every encouragement given to use large quantities of gas by having a sliding-scale.

I will just mention a few facts stated by a chairman of an electrical committee, and also an electrical engineer, to confirm my remarks. Upon a question being put to the chairman as to the excessive accounts over the corresponding period for gas, he remarked: "Customers must not look at their money, but consider the convenience, healthiness, and excessive cleanliness over the previous periods of gas." An electrical engineer in trying to persuade a customer said: "Taking everything into consideration, electricity at 4½d. per unit is cheaper than gas at 2s. 10d. per 1000 cubic feet." The foregoing is only a sample of the remarks we must be prepared, by actual figures, to lay before any of our wavering customers; and if they then decide to adopt the electric light, they must take the blame themselves, and not grumble at the excessive accounts. Another serious point is the meter question. Why should we, for the sake of a stand-by, have several hundred pounds lying actually dormant for some of our old customers to have in case the fostered babe should fail to wake at the proper time? Mr. Garcke, the Managing-Director of the British Electric Traction Company—one of the largest companies in the country—said: "If electricity is to compete, from a cost point of view for illuminating purposes, it must be sold at a less price than 6½d. to 3⅜d. for lighting, and 3¾d. to 2d. for power purposes."

As regards price for power gas, you will find that, according to Mr. Paterson's paper read at the Gas Institute meeting in 1899, that with Dowson gas, having a calorific value of 140 to 150 B.T.U., the cost was over 3d. per 1000 cubic feet; while coal gas of 17-candle power will give us from 630 to 680 B.T.U.—allowing us to charge, when all figures are deducted for depreciation and interest on power-gas plant and the extra quantity required to be used, about 1s. 6d. per 1000 cubic feet for coal gas. I think that if these figures are used in a judicious manner, we shall have little difficulty in retaining our customers, and also in supplying at that price.

Another point is photography, which can be easily undertaken by any gas manager, who, with a few hours' trouble, may obtain a valuable customer. It has been said that photography could not be done by gas; but recent experiments show that an effect equal to daylight can be obtained by eight "York" burners judiciously placed. The exposure is very little longer than daylight, for children can be taken and a beautiful picture produced.

Discussion.

The PRESIDENT (Mr. A. B. Walker) said that the paper bristled with points for discussion, and he hoped they would be taken full advantage of.

Mr. T. H. DUXBURY (South Shields) said the title of the paper was one which gave plenty of food for a body of gas managers to discuss. One of the most important points brought forward was that of low-grade gas. They were all agreed as to what they were to supply in the future. What he meant more particularly was as to how the low-grade gas was to be manufactured. The tendency, so far as he could see, was to use a cheaper coal, coupled, possibly, with blue water gas; but while Mr. Anderson concluded that they should be allowed 1s. 6d. on to the top of their standing charges, he was afraid they would not be able to do that just yet. So far as figures were concerned in the comparison of gas with electric light, he was afraid they were a little more unfavourable to electricity than he had been able to get himself. He made out that at South Shields, where the Corporation had their own electric light undertaking, they charged, on the maximum demand system, 7d. and 2d.; and in the Chairman's speech he gave the average receipts as 4⅛d. per unit over the whole of last year's account. Their present price of gas was 3s. per 1000 cubic feet, less discounts of from 7½ to 20 per cent.; and he made out that, with an ordinary Kern burner, incandescent gas lighting came out at $\frac{1}{10}$th the cost of electricity at 4½d. per unit. For motive purposes, Mr. Anderson mentioned the figure of ½-horse power per Board of Trade unit. There, again, he thought the electricians did a little better than that. At any rate, quite recently he had been in competition, as it were, for the motive power required for a new dock in South Shields. They needed about 660 brake-horse-power; and they wanted it split up. As a matter of fact, the inquiry made of them was for the supply of six gas-engines—two of 160 brake-horse-power, three of 85 brake-horse-power, and one of 30-horse power. He calculated that they would require, for a safe margin, about 10,500 cubic feet of gas per day, which would cost, allowing 20 per cent. discount 24s. 4d. Taking electricity at the cost of production in South Shields—not the selling price, because he knew they were going to cut for the order—it would have cost 50s. 5d. This showed a difference of 26s. 11d.—practically one-half. That, again, brought him to the point as to how far gas companies were prepared to cut their prices in order to get hold of these day loads. He supposed they had all seen the letter of Sir George Livesey in the "JOURNAL OF GAS LIGHTING" that week, on the subject. It appeared to be his opinion that the proposed charge at Nottingham was too low. Again, referring to their electricity friends, he had occasion recently to analyze the accounts of the South Shields electricity undertaking. They charged 7d. and 2d.; and, assuming that all he power load came on at the 2d. rate, their net cost of production, excluding interest and sinking fund charges, worked out at t⅛d. per unit, which left a margin of 0·07d., which, again, was 50 per 1ent. on to the net cost of production. So that they would not, chave been attempting to sell below cost price. On the other hand the 50 per cent., on the top of net cost of production for interest and sinking fund, brought up their charge to 3·03d. Therefore he took it that the electricians, in cutting for the power load, were certainly going to exclude the greater portion of the standing charges; and he thought this was a question which gas companies would also have to take up. In his case, taking the net cost of production, and adding 50 per cent., practically brought him to the price they were now charging for the power load. Mr. Anderson touched on the question of rate aid—the question of corporations who had electric plant installing it immediately in all their public buildings. He quite sympathized with Mr. Anderson in this respect. In his case, they had not only done this with the Corporation buildings, but had applied it to street lighting. As a matter of fact, last year over one-third of the current generated by the South Shields Corporation was used in the public lamps. Mr. Anderson did not know very much about sulphur purification; but if they were to reduce their costs down to the lowest possible minimum, certainly the elimination of the sulphur compounds would account for, at any rate, 1d. per 1000 cubic feet. Personally, he would be inclined to let the sulphur compounds go forward, and save the 1d. per 1000 feet.

Mr. H. LEES (Hexham) said when he learned that Mr. Anderson was going to read a paper on the future of gas, he at once felt interested. Two or three months ago it was prophesied that the plant over which he had charge would, in a few years, become obsolete, inasmuch as electricity would take its place. However, he felt that Mr. Anderson would give him some comfort, and a longer period in which to make arrangements for obtaining his livelihood; and, of course, one was not disappointed in that. But he did feel disappointed that, while the title was "The Future of Gas," the paper did not quite justify the heading. Nevertheless, it had certain very useful points in it. A more suitable title would have been "How to Meet our Competitors." Ten years ago any paper of this sort would have dealt with the competition of oil; and this was a significant fact. Perhaps it was not that they had altogether passed this state of matters, but that they had found the means of meeting it; and in this respect they were making progress. The position of affairs to-day did not quite justify them in speaking of electricity as was sometimes done. During twenty years it had been growing; and they might fairly give the electrical industry credit for having attained its majority. While it was spoken of as he had indicated, he did not think the author of the paper meant it quite in that sense. He no doubt looked upon it as a serious competitor. With regard to the point Mr. Duxbury raised in the latter part of his remarks, he thought the time had come when, on corporations going to Parliament for power to supply electricity, an effort should be made to prevent any rate-aid being given. The question of low-grade gas was receiving consideration; and there, again, one of their greatest difficulties was that some corporations objected to the lowering of the illuminating power without understanding the question. Corporation committees published the illuminating power of the gas they supplied; and these were quoted against gas companies who had lowered their standard. Companies did not publish their results in the same way; and it was taken for granted that they supplied the lowest possible quality. In parliamentary inquiries, the matter had been again and again fought out. It was not likely that it would be fought out so often in future, because practically Parliamentary Committees had come to see that the illuminating power should be somewhere about 14 candles. He was interested in the result of the gas-fire experiment which Mr. Anderson made. If by the consumption of 13 cubic feet of gas, the temperature of a room could be brought up 13°, it seemed a fairly good result—one they might fairly well take credit for, as leading to the hope that they should have a better sale for gas-stoves than they had had. But the test, perhaps, lacked some essentials upon which to form a judgment. A good deal depended upon the size of the room, and also the temperature when the test was commenced. With regard to the burner tests, he noticed what was, perhaps, a discrepancy in one place, where the author spoke of a light of 130 candles for 7 cubic feet of gas. This was not an extraordinary result with intensified incandescent gas lighting. They knew

that ordinary incandescent gas-burners would give a result something like this; and they expected that with intensified gas lighting they would do very much better. At a later stage the author spoke of a light of 30 candles per cubic foot of gas. Presumably this was high-pressure lighting, although it was not made clear. These were points which ought to be made clear, because they would be taken hold of; and if they were not quite correct, they might probably be used against them. He hoped it would not be said that, at any rate, managers of gas companies sent out their gas in such a condition as to disfigure ceilings in the way that was suggested there, by sulphur compounds. As the Manager of a Company undertaking, he protested against such a thing being said of his gas. With regard to the question of convenience and readiness in use, he supposed that gas could not compete with electricity. When, however, it came to cost, they were in a very favourable position; and he took it that, while they held this position, they should leave no stone unturned to improve it—not only with regard to using the best burners which could be supplied, but by endeavouring to bring down the cost of gas in every way. He believed that if this were done, the future of gas was not less well assured than it was twenty years ago.

Mr. A. C. Hovey (North Shields) said that they had, up to the present time, succeeded in holding their own very well against electric light and electrical power. There were, however, other competitors—including power gas and oil. Oil was still used for lighting to a very large extent where slot meters had not been installed. In Tynemouth and North Shields, they had installed over 6000 slot meters within the last three years. Before that time, it was a very common thing to see tanks of oil going through the streets, and large quantities being sold. He had not seen one of these tanks for months past, which showed that oil. had been a competitor, but was now being put in the shade The figures Mr. Anderson had given them had been conclusive; but he did not know that they would convince many but those who were there. As he said, he had been to meetings of electrical engineers, and had heard contrary figures—and the public read both sides. He was sorry for the public, because the man in the street was not an expert, and he saw the two contrary things which were put forward in favour of the respective commodities. The man in the street therefore said that time alone would tell. He thought that the progress which the electric light had made had not been such as to cause any very great congratulation among the supporters of it. A figure was given in the paper as to power. He was not an expert; but he thought that the Board of Trade unit was equal to $1\frac{1}{3}$-horse power, which would materially raise the figure given in favour of electricity, instead of being in favour of gas, to that extent. Recently he noticed a speech made by the Chairman of a local Electric Company, at their annual meeting, in which he said that they intended to fix penny-in-the-slot installations, and that for a penny they would be able to supply an 8-candle power lamp for $5\frac{1}{2}$ hours. He should be very sorry indeed to be in a room supplied with a light of that kind. The class of people whom it was intended to supply were in a district mostly inhabited by miners; and he recently heard a story of what a pitman—an unbiassed and shrewd man—thought of the incandescent electric light. He said it was like a red-hot hairpin in a glass bottle. If they tried to read by an 8-candle lamp, he was afraid they would not succeed. In North Shields, they supplied 28 cubic feet of gas for 1d. This would give a light of 70 candles for eight hours, which was 560 candles for one hour. The light spoken of by the Chairman of the Electric Light Company was 44 candles for one hour; so that gas was better in the proportion of twelve to one.

Mr. A. Allan (Scarborough) remarked that they, as gas engineers, of course made comparisons against electricity, owing to its dearness. Why could not they advise people as to the cheapest way of having electric light, if they would have it? There was no cheaper way, he thought, than by generating it by means of a gas-engine, as it could be done at probably one-third of the cost of a supply by any electric lighting company at present. In Scarborough, several people had put in installations of electric lighting plant, and generated the electricity by means of gas-engines. In one particular case he had had the cost worked out, and, after allowing for depreciation, wear and tear, and all expenses, he found that they were getting their current at about $2\frac{1}{4}$d. per unit. If gas engineers would bestir themselves, they would benefit themselves greatly. There was no doubt that the electric light had come to stay. People liked it, and he did not see why they should not. It would be to the advantage of gas suppliers if they could get gas-engines put in; and it would certainly be better than making adverse comparisons with regard to the cost of the light. In the case of gas companies who had not canvassers, he thought they might go about the work in a more economical way, by making use of the backs of accounts to point out the advantages of using gas. He himself did this. A short time ago, one of the principal churches in Scarborough was lighted by gas. Electricity was put in; but the congregation found it to be very uncomfortable to sit in the church—the light was so bad. The Vicar consulted him in the matter, and he had installed incandescent gas lighting, which had been a great success. They had now both the lights going at the same time.

Mr. J. H. Wright (Sheffield) said he observed that Edison's patent accumulator was to be placed on the market shortly. It was said that electricians would be able to do away entirely with storage. This meant that much less gas would be used; and he thought the remedy was to reduce the price of the gas. Another point in the future of gas was the hiring of appliances. These, in his opinion, were not pushed sufficiently. As regarded the sulphur compounds, about two years ago the Chairman of the Sheffield Gas Company said that his house had not been done up for twelve years. The Company were not under the sulphur clauses; and he thought this spoke very well for the non-destruction of paintings by gas.

The President said the first point which struck him in connection with the paper was that which had been mentioned—the putting on of two or more canvassers. He quite admitted—and perhaps he might have had a little more experience of both sides of the question—that this was sometimes done; but they could not wonder that it was necessary, if, as they were told, gas was sometimes sent out without purification, so far as sulphur compounds were concerned. Regarding the question of power gas, and also the fact that gas-engine manufacturers were now making power-gasplant, he knew that this was the fact; but he also knew, from experience, that gas-engine manufacturers would not try to cater for power-gas plant, provided the gas engineer in the district would take up the position of helping them. He had had several people who made producers in his district, and he likewise had one or two gas-engine people who made producers also; and he found that, by endeavouring to get their orders, they sought to advise people to use coal gas for their engines. He knew that coal-gas engine makers, as a rule, would rather have coal gas used in their engines than producer gas, for the reason that the wear and tear was not found to be so great. Again, they could guarantee the power in their engines to be greater with coal gas, on account of the higher calorific value of the coal gas. On the question of illuminating power and some other matters which Mr. Lees touched on—parliamentary business and legislation—which he had been having contact with, as his own Company had been having, he did not wonder at that, perhaps, rankling in his mind. In his own case, they asked power to reduce to 14 candles. To that they had considerable opposition. They offered a penny reduction; but the opponents would not accept. They went up to London to oppose them; and at the last moment, after they had had a conference again, the opponents came, hat in hand, and were glad to take it. Their Counsel had advised them that they had got as much as they would have got if they had gone forward. However, the expense fell upon the Gas Company, because they had to pay all expenses to get them to drop their opposition. On the question of legislation, it seemed to him that that which had taken place in connection with electric light companies and the legislation under the Gas-Works Clauses Acts were quite different. In Gas Bills, gas companies were prohibited from allowing discounts to any amount they might wish. No electric light company was treated in this way. In his district he knew a company which had quoted a regular price of $\frac{3}{4}$d. per unit to get the supply of electricity for power. He did not say it would not pay them. Owing to the introduction of electricity, they dropped something like 100 million cubic feet of gas at Walker; but they had got all this back, owing to having put in 1200 or 1300 prepayment meters. But they must remember that for these extra consumers, at £5 apiece—which he thought was a fair figure—they had something like £6000 of extra capital to earn dividends upon. So that if they could get and keep power consumers, he said certainly get their discounts as large as they could, but do not let the consumers have gas at a figure which would not pay. Certainly if they looked at the matter carefully, they would find that they could allow much larger discounts than they were apt to think advisable. He knew how electricians made up their calculations as to the cost of gas. They went on the cost of flat-flame burners, consuming 2 cubic feet of gas per hour, giving a light of 2 candles per cubic foot. They were able to point to several places where, at meetings like that, such a thing had been stated to exist. This gave them, roughly, 2000 candles per 1000 cubic feet. Then 32 8-candle lamps gave them the 256 candles for an hour. At $4\frac{1}{4}$d. per unit this came to 2s. 10·65d. as an equivalent. He concluded by thanking Mr. Anderson for his paper, and expressing the hope that he would have something further to add in his reply to the various remarks made.

Mr. Anderson said he did not mean, in his reference to purification, that dirty gas went out, but that most of the companies and corporations did not trouble about the sulphur clauses. As regarded the size of the room where the experiments were made, it was 15 feet by 12 feet; and the temperature was identical in each case, to commence with. As to the horse power, he might be wrong. He took it from an electrical engineer's book; but he would look the matter up. He had already 1158 slot meters in Middleton—nearly everyone fitted up either with a cooker or a griller. People putting in their own electrical installations was one of the things he had in his mind when he suggested the hiring out of gas-engines. He let out gas-fires on a 10 per cent. basis, and at present had more than 1000 of them in use. He thought they were doing all they possibly could; but at the same time they wished to keep up to date, and see that no consumer should be driven away. This was really the object of his paper; and he hoped he had attained some slight part of what he purposed. He thanked the members for the way in which they had received his remarks, and was gratified that they were all pretty well agreed with one another.

MANCHESTER AND DISTRICT JUNIOR GAS ASSOCIATION.

The monthly meeting of the Association was held on Saturday at the Manchester School of Technology; and there was a very good attendance. In the unavoidable absence of the President (Mr. S. E. Halliwell), the chair was occupied by Mr. W. HILL, Vice-President.

The HON. SECRETARY (Mr. F. Oldfield) having read the minutes of the last meeting,

Mr. GARLICK said he should like to ask what had been the result of the interview with Mr. J. H. Reynolds, the Principal of the Manchester School of Technology, by the deputation appointed at the last meeting to ascertain what arrangements could be made with regard to a special class being formed for the purpose of obtaining technical instruction in connection with the manufacturing of gas, and also what response had been received from members of the Association as to the number of probable attendants at such a class.

The HON. SECRETARY replied that so far there had been about 20 applications. Mr. Reynolds had informed the deputation that if they could get together from 20 to 25 members willing to join, he would be prepared to form such a class. He was, however, in some difficulty as to selecting a suitable teacher; and he had suggested that the Association might find someone having special qualifications to fill such a position.

The CHAIRMAN said they were all agreed that calorimetry would be a most important factor in the testing of gas in the future; and the sooner they became thoroughly acquainted with this system, the more it would be to their advantage. The paper which Mr. Fearon, who was a teacher of "Gas Manufacture" in Manchester, had, in the absence of the paper promised by Mr. Stoddard, so kindly prepared for them on this subject, would therefore, he was sure, be of special interest to all the members.

Mr. E. FEARON (Salford) then read the following paper:—

CALORIMETRY.

To anyone who is of an observant turn of mind, it must be evident that the usual methods of gas supply in vogue up to the present time will undoubtedly undergo a radical change in the near future. Ever since gas was first introduced into our streets and houses, the question of its illuminating power has been paramount; and rightly so, under the old conditions, as there must always be some standard or other to which buyer and seller can refer when the quality of the material sold is to be determined. But the conditions have changed very greatly in the last ten years or so, due to the use of gas as a heating and motive power, and to the introduction of incandescent lighting; and there is now no necessity for supplying gas of 18 to 20 candle power, and over, as is done in the north of England and in Scotland. That this is being recognized, is shown by the passing of the South Metropolitan Bill, which granted the Company permission to supply gas of 14 candles; and all over the country the tendency is to reduce the illuminating power of the gas supplied. On the Continent, gas of much lower quality is sent out; 10 or 11 candle power being quite common in some of the large towns in Germany —*e.g.*, Magdeburg, Dessau, Bremen, &c.

If, however, the old standard is to be discarded, we must substitute another; and there can be little doubt that the new standard will be the calorimeter, as the heating power of the gas will then be the all important factor. That being so, it is necessary that everyone connected with the manufacture of gas should be familiar with the methods of determining its calorific value. One way of doing so is by calculation, from an analysis of the gas. The following table gives the calorific value ascribed to the various heat giving constituents of coal gas:—

	1 Cubic Foot of Gas at 60° Fahr. 30 In. Bar.
Hydrogen	325·0 B.T.U.
Marsh gas	1024·0 ,,
Carbon monoxide	323·5 ,,
Heavy hydrocarbons	2484·0 ,,

From these all the heating power is derived; and having obtained an analysis of the gas in question, it is a simple matter to calculate its calorific power.

An analysis of high-grade gas, such as is supplied in Manchester, would give about the following percentages: Hydrogen, 46; Marsh gas, 35; heavy hydrocarbons, 6·5; carbon monoxide, 6; carbon dioxide, 2; oxygen, 0·5; and nitrogen, 4. Taking the values and multiplying, we get—

46·0	× 325	= 14,950
35·0	× 1024	= 35,840
6·5	× 2484	= 16,146
6·0	× 3235	= 1,941
		68,877

Or 688·77 B.T.U. per cubic foot of gas.

As, however, an accurate analysis of a gas is a rather lengthy proceeding, requiring considerable technical skill on the part of the operator, such a method of obtaining the calorific power is seldom employed.

The alternative method of determining it is by means of a calorimeter, in which a known volume of water is heated by a known volume of gas. Until fairly recently, very few gas-works possessed such an instrument; as, before the late Mr. Hartley produced his calorimeter in 1884, the only ones in use were cumbersome and not easy to manipulate. At the present time, there are several on the market, mostly based on the Hartley pattern, of which probably the best known is the Junkers. I have brought one with me for your inspection; and, as you will see, it consists of a metal combustion chamber, surrounded by a water-jacket, through which passes a double row of vertical tubes, open at both ends. The products of combustion pass through these tubes in a downward direction, while the water flows outside them in an opposite direction—thus cooling the products to the temperature of the water. The water is led to a regulating funnel, designed to keep a constant head; and from there it passes through a quadrant cock, and over the bulb of the inlet thermometer into the body of the instrument. Here it becomes heated, and rises to the top, past a series of baffle-plates, to the outlet funnel, encountering on its way the bulb of the outlet thermometer. From the outlet funnel, the water either runs to waste or is led into a measuring vessel. The gas to be tested passes first through an accurate experimental wet meter, and then through a delicate bell-governor, in order to ensure an unvarying pressure.

In order to make a test, the water is turned on; and when running from both overflows, the gas is lighted in the bunsen burner, and consumed at the rate of about 6 cubic feet per hour —the speed of the water being regulated till there is a difference of some 10° C. between the inlet and outlet thermometers. After a few minutes have elapsed, and the difference between the inlet and outlet is constant, and the condensed water is dripping from the small pipe at the bottom, the test may be commenced. The air-inlet of the burner must be regulated till the right quantity is being admitted, which can be seen by observing the flame by means of a small mirror. Wait till the pointer of the meter reaches the zero mark, then quickly switch the outlet water-tube from waste to the measuring vessel, and when the pointer again reaches zero reverse the operation; in the meantime having carefully noted the readings of the two thermometers. From the data so obtained, it is a simple proceeding to determine the calorific value. For instance, supposing that $\frac{1}{12}$ cubic foot of gas has been consumed, and that 1400 cubic centimetres of water have been raised from (say) 16° C. at the inlet to 25° C at the outlet. Then—

If $\frac{1}{12}$th cubic foot has raised	1400	c.c. through	9° C.	
1 ,,	wou'd raise 16,800	,,	,,	9° C. and
1 ,,	,, ,,	151,200	,,	,, 1° C.

The unit taken is the calorie, which is the amount of heat required to raise 1 kilogramme (1000 c.c.) of water 1°C.; so that, dividing by 1000, we get 151·2 calories as the heating value of our sample of gas. The quantity of gas consumed must be reduced to standard conditions—*i.e.*, 60° Fahr., and 30 inches pressure. Suppose the temperature of the gas in the meter to be 62° Fahr., and the barometer to be at 29·9 inches, the tabular number is 0·991, and 151·2 ÷ 0·991 = 152·5 calories.

This is the gross calorific value; and in order to obtain the efficient heating value, it is necessary to deduct the amount rendered latent. This is done by collecting the condensed water resulting from the combustion of 1 cubic foot of the gas. A small measuring glass is placed beneath the tube at the base of the calorimeter, and the condensed water collected therein; then each c. c. so collected corresponds to 0·6 calorie. Assuming that 22 c. c. are collected, that gives us 13·2 calories which must be deducted to obtain the net value: 152·5 − 13·2 = 139·3 calories.

The foregoing may be stated simply thus:

$$\frac{\text{Volume of water in litres} \times \text{difference in temperature}}{\text{gas consumed.}}$$

= calorific power of 1 cubic foot of gas (gross).

In England, the British thermal unit is the standard; and this is the amount of heat required to raise 1 lb. of water through 1° Fahr. To express calories in B.T.U., it is necessary to multiply by 3·97, so that 139·3 × 3·97 = 553·02 B.T.U.

If reliable tests are to be made, absolutely similar conditions must prevail; and to insure this, several precautions must be taken, of which the principal are: (1) A constant head of water. (2) Exclusion of all draughts. (3) An automatic switch to allow the water to flow from waste to the measuring vessel, and *vice versâ*.

The first can be met by having an overhead tank, fed by a ball-cock, whence the water is led to the inlet of the calorimeter. The second is not so easily dealt with, and will require a special room with double doors, &c., and provided with proper inlets and outlets for the air, so arranged that the volume of air can be frequently changed without causing draught. It also entails great care on the part of the operator to avoid movement as much as possible during the time a test is in progress; and this brings us to the third requirement—an automatic switch. It should not be a difficult matter to arrange one, after the fashion of the automatic cut-off in the Referees sulphur test, actuated by the meter itself; thus reducing the chance of error to the reading of the thermometers. Another requisite in the ideal calorimeter is that the two thermometers should be side by side, the outlet slightly lower than the inlet, so that the tops of the two columns of mercury would be almost on a level during a test, and the reading of them thereby simplified, thus further reducing the chance of error.

The Simmance and Abady calorimeter is one of the most recent to be placed on the market, and possesses several improvements. In order to ascertain whether the flow of water is constant, a gauge-glass is fitted on the inlet, the least variation in water pressure being at once apparent; and if it occurs while a test is in progress, such test can be discarded. Another improvement consists in haviag a swinging bucket-shaped funnel fixed on the outlet-pipe, and weighted so that normally the water is directed into another funnel, and runs to waste. When it is desired to make a test, the measuring-jar is placed in position; and as the meter point passes zero, the bucket is swung over in a fraction of a second, without causing any alteration in the flow of water, as was the case with the rubber tube used in the older forms. The thermometers, too, are large open scale ones, and placed side by side, thus facilitating the reading of them. The patentees recommend the use of very small quantities of gas—say, $\frac{1}{10}$ cubic foot—as the possibility of error while making a short test is less than in the case of a long test, in which as much as 1 cubic foot of gas is used.

An important consideration, if the calorimeter is to supersede the photometer, or be used in conjunction with it, is the standardization of the instrument, which will probably be carried out by the Standards Department of the Board of Trade. A pure gas of known calorific value, such as hydrogen, would appear to be the most suitable for this purpose, although pentane air gas, as used in the Harcourt lamp, has also been proposed; and all instruments would be stamped, and sent out with a certificate stating either that they were correct, or (if not) giving a constant by which to correct the readings.

It is well known that the calorific value of a gas is not lowered proportionately as the illuminating power is lowered; and some tests which have been made on various qualities of gas show this very markedly, also the wastefulness of supplying rich, high-priced gas to be consumed in incandescent burners, gas-engines, cookers, &c., when a cheap gas of a little less heating power could be supplied, to the great advantage of everyone concerned.

TABLE I.

Gas Made from—	Illum. Power at 5 Cubic Feet per Hour. Candles.	Calorific Value B.T.U. Gross.	B.T.U. per Candle.
Cannel	24·70	694·83	28·13
Mixed coal and cannel	20·13	624·42	31·02
Coal only	16·00	564·42	35·28
,,	13·23	556·79	42·08
,,	10·09	514·27	50·96
10-candle gas enriched with benzol	24·70	620·60	25·12

That the efficiency of incandescent burners is not impaired by consuming low-grade gas in them, is proved by the following comparative results which I have obtained:—

TABLE II.

Burner Used.	Consumption of Gas per Hour. Cubic Feet.	Illuminating Power. Candles.
Standard argand	5·0	18·85
Welsbach "C"	3·5	54·25
Standard argand	5·0	15·09
Welsbach "C"	3·5	55·00
Standard argand	5·0	19·07
Welsbach "C"	3·5	58·32
Standard argand	5·0	9·13
Welsbach "C"	3·5	54·50
Standard argand	5·0	6·55
Welsbach "C"	3·5	47·08

It may be as well to remark here that some difficulty arises in assigning the true illuminating power to a low-grade gas, as so much depends upon the rate at which it is consumed in the burner; and no doubt some of the conflicting results that are published from time to time are due to this. The gas in Table I., having an illuminating power of 10·09 candles, was tested with the flame filling the chimney, and burning at the rate of about 6·25 cubic feet per hour. The same gas, consumed at the rate of about 5·25 cubic feet per hour, gave only 4·86 candles; the values in both cases, of course, being reduced to the standard rate of 5 cubic feet.

[At the close of the paper, the author gave a practical demonstration of the action of a calorimeter of the Hartley pattern.]

Discussion.

Mr. GARLICK said the members were all very much indebted to Mr. Fearon for bringing this important matter before them. From what had been stated, it would seem that the object of gas engineers in introducing the calorimetric system of testing was to reduce the cost of manufacture for heating purposes, and consequently to lower also the price to the user. It had been shown to them that, with the incandescent mantle, the same illuminating results could be obtained from a cheap low-candle gas as from a dearer gas of high power, and that for heating purposes simply it was a waste to manufacture the more costly gas. If this was the case, they would be in all the better position for successfully competing with electricity in the future.

Mr. FEARON remarked that there was also the absolute exactness of the calorimeter that was an advantage in the test as to the relative values of gas. If the calorimetric test were to be taken as the standard, it would be much more satisfactory than the test for illuminating power.

Mr. THORPE said he had known gas-works tests to vary considerably; and he would like to know if it was a fact that testing by the calorimeter never varied. He should think difficulties would sometimes arise with different burners.

Mr. FEARON replied that the use of different burners would not be allowed; the burner would be standardized.

Mr. THORPE said the actual cost of manufacturing the gas and its relative calorimetric value would, to his mind, be a more accurate and more valuable comparison than one with its relative candle power.

Mr. FEARON explained that in producing low-candle gas the cost of manufacture was proportionately reduced. They could make gas of good calorimetric value from slack at 6s. per ton, whereas to make gas of high candle power they had to use coal at 11s. to 12s. per ton.

Mr. GIMMIN suggested that the heat-giving power of 18-candle gas might be different from that of 16-candle gas; and he asked if there were no means of getting at the ratio of difference.

Mr. FEARON replied that a ratio might be got at; but it would not be reliable.

Mr. NUTTALL said he understood that they got the same heat efficiency with a low quality of illuminating gas as with a high quality; but he wished to know if this was not in some measure owing to the construction of the burner. He did not think a 13-candle gas was so efficient for heating mantles as one of 18-candle power.

Mr. FEARON said there were chemical changes going on in the gas independent of the illuminating power; and certainly the results of tests had shown that the low-candle gas was quite as efficient for heating purposes as the high-candle. If they took some of the German towns which were supplied with low-candle gas, they would find that they were probably the most brilliantly lighted places in the world.

Mr. MOSELY remarked that at their works they had been testing every hour their gas, which was a mixture of carburetted water gas and ordinary coal gas; and at specified times it varied as much as one-candle power. He did not understand why there should be such a variation.

Mr. FEARON: Do you use the same pair of candles?

Mr. MOSELY: Yes.

Mr. FEARON thought there might possibly be some stratification of gas in the holders. He had known variations of half-a-candle when different candles were used; but he could not explain the variation Mr. Mosely had mentioned. He had not, however, had any great experience with carburetted water gas.

The CHAIRMAN said the paper had been a very interesting one, and he had great pleasure in moving a hearty vote of thanks to Mr. Fearon for the valuable information put before them.

Mr. NUTTALL seconded the proposal; and it was cordially adopted.

Mr. FEARON, in briefly responding, said he had been very pleased indeed to bring forward the subject he had dealt with. There had not been a paper on calorimetry before the Association, and it was certainly a matter which during the next two or three years would be very much to the front. In fact, judging by the clauses which were at present being introduced into Bills, it was quite evident that legislation on the subject would take place before very long. If the members of the Association had derived any information of value from his paper, he had been more than repaid.

The proceedings then closed.

NEW ENGLAND GAS ENGINEERS' ASSOCIATION.

(*Concluded from p.* 156.)

High-Pressure Distribution.

Mr. W. A. Learned, of Newton (Mass.), contributed some notes on the above subject. He supplied eleven villages with gas, covering an area of 25 square miles, and branched out 3 to 6 miles from the works. The elevations varied from 18 feet to 240 feet above low-water level. Four of the villages were about on the same level as the works; and the problem was how to increase the pressure in these places, and also how to fill a holder 3½ miles from the works. To serve this purpose, a high-pressure pipe-line was laid 9600 feet long, using 6-inch cast-iron pipe, with Dresser bell and spigot joints, and the usual compressors and condensers. This line was as good as a 20-inch pipe under ordinary pressure, and could be used as a supplementary supply to the low-pressure main. At present it afforded a large margin for future extensions. The Dresser joints comprised a bell somewhat smaller than the usual pattern, cast with a double bevel or edge, a rubber packing-ring made with a V-shaped recess fitting over the bevel edge, and two malleable iron rings, which, when drawn up by bolts, compressed the rubber and formed a sound joint. The rubber was hermetically sealed from contact with the gas in the pipe or the surrounding earth. He claimed several advantages for this form of joint. It was a perfect expansion joint. It could be laid with ease and facility—on top of the ground if preferred, being lowered afterwards, thus enabling the work to be done with a narrower trench. It was also proof against electrolytic action. In putting the pipes

together, a ring of asbestos was first inserted into the bell, on which the spigot end was bedded. The socket was then filled to half its depth with cement, the rubber ring placed in position, and the collars screwed up. He described a means by which this system could be adapted to ordinary joints. The last 1000 feet of the pipe-line was laid in this manner, on account of the non-arrival of the special pipes. The whole was tested to 40 lbs. pressure after laying, and proved absolutely tight. The pipes were laid from 2 feet to 3 feet deep, or within the frost area; but with dry gas and flexible joints he could defy frost. At present, the line would only be used as a high-pressure system during the winter evenings, to take off the peak of the load in the heavy season. The remainder of the time it would be used under ordinary pressures. The compressors included 12-inch steam cylinders, with a Meyer adjustable expansion cut-off, 16-inch air cylinders, and 16-inch stroke. The result of tests, with a steam pressure of 68 lbs., showed 3·76 indicated horse power at the steam end, and 3·38 (equivalent to 90 per cent.) at the gas end, and 32,000 cubic feet of gas per hour compressed to 5 lbs. per square inch. There was a Chaplin-Fulton low-pressure regulator fixed at the far end. He had made some careful photometrical tests, using Sugg's "F" argand burner, to determine the loss of quality due to compression. Samples of 16-candle coal gas, compressed to 10 lbs., lost 0·4 candle; and a 14·8-candle gas, 1·6 candles. A mixed coal and water gas (22 per cent. water gas) lost 0·5 candle at 10 lbs., and an additional candle at 20 lbs. pressure. A second sample lost 3 candles at 20 lbs. pressure, and another half candle at 30 lbs. Some chemical analyses were also made, which went to show that the illuminants were not reduced by compression; but there was a loss of free hydrogen to the extent of 2 or 3 per cent., and a corresponding gain of nitrogen. At 5 lbs. pressure, it was found that the quality of the gas was improved by reason of the removal of moisture; at 10 lbs., he found that 65 per cent. of the moisture was removed; and at 20 lbs., practically the whole. Pumping 18,200 cubic feet of gas at 10 lbs. pressure at the inlet, the pressure at the outlet end was 9·28 lbs., showing a loss of 0·72 lb. It was found that 39,000 cubic feet of gas compressed to 5 lbs. deposited 150 oz. of water and 41½ oz. of hydrocarbons; raised to 10 lbs., 179 oz. of water and 11 oz. of hydrocarbons; and raised to 20 lbs., 280 oz. of water and 20 oz. of hydrocarbons. The specific gravity of the hydrocarbons was about 0·890.

Mr. Coffin, of Schenectady (N.Y.), who was called on by the President to open the discussion, said he was working a line at high-pressure that was intended to handle 14,000 cubic feet of gas per hour. The pipe was a 4-inch one; and when delivering that quantity, the pressure was 36 lbs. at the inlet, and 25 lbs. at the outlet end. The length of the line was 4300 feet. It had only just been started; so he could not say more than that it was sound, and worked satisfactorily. Mr. Richardson was putting down 12 miles of high-pressure line—a 3-inch pipe 6 miles in one direction, and a 4-inch pipe 6 miles in the other—to replace two small works. The gas would be turned into the ordinary low-pressure system through a pressure regulator. The President thought it important to notice that the author had apparently decided not to exceed 10 lbs. pressure. Mr. Shelton said the author was entitled to the credit of introducing the high-pressure system in New England; and he would be largely followed when its advantages were fully realized. The author, he understood, was using no auxiliary holders, but distributing right away from the works; using pressure-reducers where required. This was the system with which he had been identified for the last two years, since which time some thirty lines had been laid down, including one in Jersey about 35 miles long. A loss of from 1 to 1½ candles on a compression of 10 to 20 lbs. was more than he would have expected; and he noticed that the analysis showed that compression had practically no effect on the composition of the gas. He thought the author was the first to use cast iron for high-pressure lines. He strongly preferred wrought iron. It was usual to put after the compressor an old boiler or something of that sort to act as a cooling, steadying, and condensing chamber; and he gathered that the author introduced a water condenser at this point. This was important, because on one or two lines he was acquainted with there was some trouble from deposition of hydrocarbons in the first 1000 feet run. Beyond that, the gas was perfectly dry; and he thought it was simply a question of cooling, and that after the gas was thoroughly cooled there would be no trouble. All other matters had been almost standardized; but this was a point that had yet to be worked out. He would be glad, therefore, of any further particulars regarding it. He strongly recommended measuring the gas before compression; and in referring to attempts to measure it afterwards, spoke of proportional meters as debateable propositions or guessing machines. Care must be taken to put the meter far enough away to be beyond the pulsation of the pump. He thought it was a mistake to suppose that gas could not be compressed with advantage above 5 lbs. If it could be compressed to 5 lbs., there was no reason whatever why it should not be compressed to 25 lbs., with a corresponding gain in delivering capacity. He had only, so far, pumped water gas, but would not think of hesitating at coal gas or any other sort. The temperature of the gas at the outlet of the compressor ranged from 100° to 200°, according to the speed at which it was worked. He preferred mains of wrought iron, tarred or coated in some way, and was at present at work on a plan for encasing the pipe with ¼ to ½ inch thickness of cement. This was too costly to do by hand, but if effected it would be a splendid protection against electrolysis or corrosion. His idea was to use a moveable case or shell, and to run in liquid cement through a funnel on the top. A convenient length could be taken at one time, the work being done after the pipes were jointed up in the trench. The co-efficient of expansion was about the same for cement as it was for iron; and therefore the two materials would bond excellently. He knew very little about the Trenton 12-inch main; but he believed it was worked at 20 to 30 lbs. pressure. Mr. Africa said that one of the advantages claimed for wrought-iron pipe was that it was more flexible. It seemed to him that advantage would be lost by casing it with an inelastic material such as cement, and that the cased pipe would be as rigid as cast iron.

Mr. Learned replied to the discussion. He said that in theory 5 lbs. compression meant a temperature of 106°, and 20 lbs. 207°. He had therefore provided a water condenser, which cooled the gas to 60°. The deposited hydrocarbons were free from naphthalene. The condenser was 11 feet high, 3 feet in diameter, and contained 42 3-inch tubes 8 feet long. Water flowed through these tubes, and the gas circulated outside. He must say that there was a good fall on the first 1000 feet of pipe-line back towards the inlet, which assisted the condensation. Where a long fall back to the works was practicable, it was not necessary to spend much on a condenser. If it was absolutely essential to collect all the condensation on the works, the condenser should be larger. The first drip on his line was 1400 feet from the inlet. This was examined after 3 months' work, and found to contain 14 gallons of fluid. No doubt wrought iron was cheaper for smaller sized pipe; but for 6-inch pipes, cast iron was lower in cost. As for flexibility, the whole line was made up at ground level and lowered afterwards, with a deflection of 8° or 9° on each joint. Another reason for preferring cast iron and an insulated joint was that he was much troubled from electrolysis. The gas was measured from a station meter, and also from a small holder, and checked by a counter on the pump.

The "Question-Box."

In referring to the contents of the "Question-Box," the President asked for a statement of experiences with two purifiers of extra depth as compared with four ordinary purifiers. Mr. Pritchard said that during the last winter he used four boxes of extra depth, and was unable to keep the sulphur within the limit. Mr. Forstall remarked that at least one box must be kept charged with practically clean material; so that if there were only two boxes, 50 per cent. of the purifying capacity must be practically clean. If there were four boxes, 25 per cent. would suffice; and if six, 16. If only two boxes were used, they must be very large in proportion to the make of gas. Mr. Woodward had two deep boxes, and worked with very satisfactory results. There had been trouble with sulphur; but he obviated this by putting a layer of lime on the top in each vessel. The boxes were certainly large; but he had conveyors, &c., which enabled them to be changed rapidly. The size was 16 ft. by 20 feet by 5 ft. deep; and his maximum make was 15,000 cubic feet per hour. Mr. Coffin had found from actual tests that in a four-box set, worked three on and one off, the first box took out 75 per cent., the second 20 per cent., and the third the remainder of the sulphur. If an attempt was made to cut that down to a two-box set, the result would be a loss of 25 or 33 per cent. of the purifying capacity, with equal weights of material. In reply to a question as to the relation of Texas oil to the gas industry, Mr. Shelton said the supplies were very uncertain. He had used it at Staten Island and New Orleans with satisfactory results. At the first place, there was very little increased purification trouble or expense; but at New Orleans, where they used the straight crude oil, in no sense refined by taking out the heavier portions, the purifying charges and labour went up 50 to 75 per cent. This was Beaumont oil. The yield of tar was not appreciably greater than that from Ohio or Pennsylvania oil. But from the present status of the Texas fields, the tremendous shipments for fuel, uncertainty as to the future, the reluctance of the oil companies to make forward contracts, and the advance in price, he could no longer feel the confidence in Texas oil he did a year ago. His experience did not support Mr. Norris's suggestion as to want of permanency in the gas in cold weather.

On the subject of maintenance of incandescent lights at fixed charges, Mr. F. W. Humphreys said that at New Haven he sold a four-burner Humphrey arc light for £2 11s. 8d., or supplied it on hire at 2s. per month for nine months—no charge being made for July, August, and September. The charge for maintenance was 1s. per lamp per month, omitting the three summer months. This included cleaning twice a month and renewal of mantles. With practically no canvassing, he had half the lights sold on these maintenance terms; and the result was satisfactory. The President said the gas appliance exchange at Boston charged about 4s. 2d. per month for maintenance of arc cluster lights. The Secretary enlarged on the value of a good maintenance scheme to the gas company; and he was in favour of even undertaking the same at less than actual cost, as the loss would be more than covered in other ways.

An interesting discussion arising out of the questions "What are the proper temperatures at which to operate the various parts of a coal-gas plant?" and "At what point in the works should coal gas and water gas be mixed?" then followed. This was dealt with in the "Journal" for the 14th inst., p. 93.

REGISTER OF PATENTS.

Cooling the Pistons of Internal Combustion Engines.—M'Mullen, J. A., of Hornchurch. No. 7502; March 27, 1902.

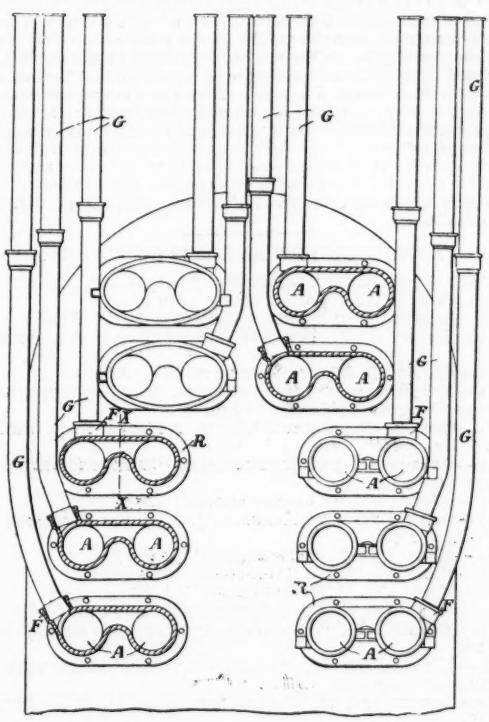
This invention relates to means for circulating water or other cooling fluid through the pistons of gas, oil, or other internal combustion engines when in motion. The patentee provides in the piston a chamber containing a pipe system comprising a stationary pipe communicating at the opposite ends with the chamber and with a supply of cooling fluid, whereby the latter is introduced through the pipe; and also means, independent of the pipe, through which the fluid is discharged. The pipe system consists of a series of stationary and movable pipes arranged one within the other, one or more of which serves or serve to introduce the cooling fluid, while the other effects the discharge. The invention can be carried into effect in various ways.

Prepayment Gas-Meters.—Sharp, J., of Glasgow. No. 8422; April 11, 1902.

This invention relates to improvements in the internal mechanism of prepayment or coin-freed gas meters. The first improvement consists in the combination of two loosely mounted crown or equivalent wheels with an intermediate gear-wheel connected to the main spindle, so as to rotate or oscillate the latter to open or close the gas-supply valve, the crown or equivalent wheels being geared respectively to the prepayment and the ordinary index mechanism of the meter; the second, in the combination of the before-mentioned arrangement with an indicating pointer mounted on the main spindle; the third, in forming a series of projecting arms on a toothed wheel mounted loose on the coin-receiver, but held in position by engaging with a train of toothed gearing connecting to the mechanism operating the gas-supply valve, each coin revolving the toothed wheel a predetermined distance, so that each successive projecting arm is acted upon by the next coin inserted; and the fourth, in combining the first-named arrangement of wheels with the coin-operating mechanism, consisting of the coin-receiver, tilting lever, and weighted pawl and toothed connecting gear to the main spindle.

Gas Manufacture.—Webber, W. H. Y., of Teddington. No. 11,328; May 1, 1902.

This invention relates to the production of gas by the carbonization of coal in closed retorts. This process is usually carried out in Ω-shaped or other fire-clay retorts, which are made of as large a cross-section as the working conditions permit, and have thick walls. Retorts of this character are structurally weak, and cannot sustain for any length of time the great heat to which they are subjected when worked for the highest yields of gas. It has therefore hitherto been the practice to keep down the temperature to what they will sustain.



With such arrangements, however, only a moderate yield of gas is obtainable. Owing to the increased facilities for enrichment of the gas, and the lower requirements as to its illuminating value, higher temperatures of working and increased yields of gas are no longer precluded, except by the well-known limitations of the present systems of carbonization with retorts of the character already described.

By the use of retorts of comparatively small cross-section, increased yields of gas per ton of coal and per retort are obtainable; but hitherto the difficulty of getting a sufficiently large output of gas per unit of ground space occupied by settings of small-section retorts constructed in the ordinary manner with one or two mouthpieces to every retort, and one or two pipes for taking off the gas, has precluded the use of such retorts except for experimental plant and gas-works on a very small scale.

The object of the invention is to effect the carbonization of coal at a high temperature in such a way as to obtain the highest yields of gas and all the other attributes of carbonization in small-section retorts without diminution of the productive capacity of the ground space occupied by the carbonizing plant, but rather with the increase thereof.

The invention consists in a new system of carbonization in which groups of two or more thin-walled tubes of refractory material of comparatively small cross-section are employed, each group communicating by the intermediary of substantial fire-clay blocks with a common mouthpiece at one or both ends—one door giving access to each group of retorts for charging or drawing purposes. Each group of tubes thus forms a sort of multitubular retort, which may be described as being of an analogous character to the elements of construction employed in water-tube steam-boilers.

The patentee finds that with this process of carbonization, employing small thin-walled tubes, a considerably increased yield of gas can be obtained in the same time, even working with the same retort-heating arrangements, over that obtained with the present large thick-walled retorts. This gives a greatly increased output capacity to each bench of retorts when constructed under the new system. In each group of retorts, although a smaller quantity of coal may be dealt with at each charge, the charges at the same temperature can be worked off so much more quickly than is the case with present retorts that a considerable increase in the output capacity of each bench results—a matter of great importance, especially where ground space is valuable.

In carrying the invention into effect according to the modification shown, the patentee employs a retort-bench in which are mounted a setting of 10 multitubular retorts, each of which consists of two thin-walled tubes A of refractory material united to a common mouthpiece or header B at one end. The header is secured to a heavy block of refractory material C, which carries the ends of the tubes. Each header is provided with a single door D hinged at E for enabling the tubes to be charged and discharged together; each header is also provided with a branch pipe F to which an ascension-pipe G is connected, leading to the hydraulic main. The patentee finds 10 inches internal diameter to be a suitable size for the tubes, two of which form a group; and the thickness is about 1 inch. The two tubes forming each group are spaced with a sufficient gap between them along their length to allow the heating gases to pass between them.

With a bench of such retorts, the patentee has found that the rate of carbonization is greatly increased; the operation being completed in two hours instead of in six as with the ordinary large retorts, working under the same conditions as to temperature. He also obtains the further advantage due to the possibility of working at higher temperatures, obtaining a greater yield of gas per ton of coal. Each retort may be made up of any number of tubes connected to a common header, and there may be a header at one or both ends of the tubes as convenient.

Carburetting Apparatus.—Laitte, B. de, of Paris. No. 28,408; Dec. 23, 1902.

This invention relates to apparatus employed for the production of gases from combustible fluids (such as light oils); the object being to provide means whereby "uniformity in the admixture of gas and air within the carburettor, and the apparatus connected therewith, may be ensured, and to eliminate the defects connected with the working of the apparatus and plant as at present ordinarily employed for such purposes, while securing means whereby the improved plant can be arranged in a more compact manner than is possible under the present arrangements."

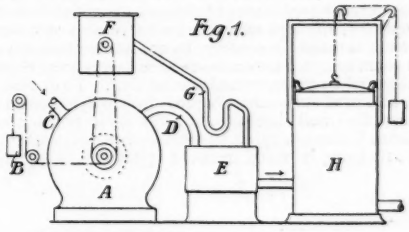


Fig. 1.

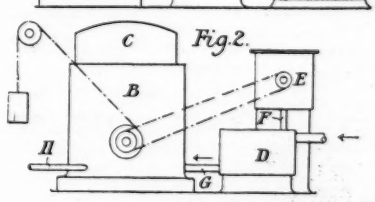


Fig. 2.

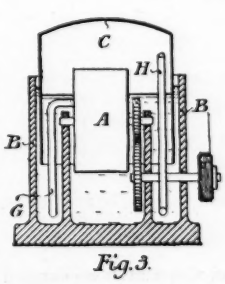


Fig. 3.

The form and process at present employed and the ordinary apparatus therefore is shown diagrammatically in fig. 1. The apparatus and process which constitute the present invention is shown diagrammatically in fig. 2. Fig. 3 shows, partly in section and partly in elevation, the interior of the blower employed, combined with the gas-reservoir.

In the older method (fig. 1), the blower A is driven (say) by a weight B, whereby air is drawn through the pipe C and is driven out through a pipe D in the carburettor E. From the blower shaft also motion is transmitted to a fan or set of vanes F, which cause the fluid to be vapourized to pass through the U-shaped pipe G into the carburettor, from which the prepared gas is led into a holder H.

In the apparatus shown in figs. 2 and 3, the drum A (driven in any suitable manner) is mounted preferably within the interior of the holder B, the bell to which C serves to regulate the pressure. Through the drum air is directly sucked or drawn into the carburettor D, to which simultaneously, from a reservoir E filled with the carburetting medium, the fluid is supplied by a set of fans or the like in suitable quantities through a short vertical pipe F. The prepared gas passes through the pipe G, drawn by the drum A, within the holder B, where it becomes intimately mixed, and is thence delivered through the pipe H for use or storage.

The patentee says he finds it advantageous to cause the blower drum to work in water, glycerine, or a solution of chloride of magnesium, below the gas-reservoir under the bell, which thus forms a seal; so that the prepared gas, on leaving the drum, is directly delivered under the bell. By this arrangement of the blower, the U-shaped tube is dispensed with, and thus no assemblage of fluid takes place when the apparatus is stopped; and when the layers of gases (should such be formed) pass through the drum, they become intimately mixed before being delivered to the holder. Since, too, the carburettor of any suitable form is not under pressure but has a slight suction instead, it can be of lighter construction, so that the inner walls can be more conveniently kept at the temperature of the outer air; while, by combining the blower and the gasholder, "great economy in space is obtained for the installation of the apparatus."

Measuring and Mixing Gas.—Boistelle, A. O., of Paris. No. 84; Jan. 1, 1903. Date claimed under International Convention, Jan. 14, 1902.

This invention relates to apparatus suitable either for producing mixtures in proportions fixed in advance for each particular case of two or more gases (illuminating gas, poor gas, water gas, carburetted air, atmospheric air, oxygen, &c.), or for accurately measuring the different gases without immediately mixing them. This mixing or simple measuring is performed "strictly in proportion to the consumption," and the arrangement of apparatus is so designed that not only does the difference between the initial pressures of the various components constitute no obstacle, but also that the variations of pressure which may take place during the process do not practically affect the exactness of the measuring. This is effected by an appliance consisting of rings of constant section divided into cells of constant capacity, and provided with pipes at their opposite ends in order to insure the exact measurement of the gases to be mixed, independent of any variation in pressure, and in order to allow the pressure at which the gases are admitted and used to be varied as desired.

Purification of Coal, Oil, and like Gases.—Clapham, W. S., of Keighley. No. 8618; April 14, 1902.

The patentee remarks that the apparatus most generally employed in the purification of coal, oil, and like gases consists of a tank, box, or enclosed space wherein the purifying substances—such as lime, oxide of iron, &c.—are placed; and these tanks are usually arranged so that access to the interior thereof is by or through a lid or cover at the top. Hence all the purifying substances have to be supplied thereto through this upper opening, through which it has often also to be discharged, unless provision is made for passing the substances through a shoot or hopper to a room or space beneath—thus entailing great expenditure of time and labour when charging and discharging. To obviate these disadvantages, and produce means whereby the purifying substances may be readily supplied and discharged, while their position may be so regulated that all the purifying properties are exhausted from every part prior to its being removed from the apparatus, is the object of the invention.

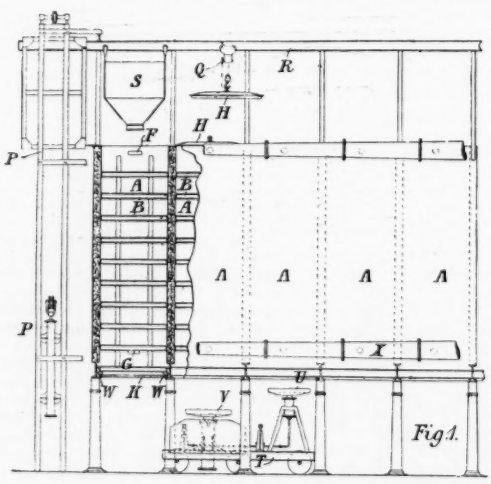


Fig. 1.

Fig. 1 is a front elevation, partly in section, of apparatus constructed in accordance with the invention. Fig. 2 is an end elevation, also partly in section, of the arrangement shown in fig. 1.

The box A is so arranged that it will receive a series of holders or grids B, which contain the purifying substances. These grids are placed so that they may be supplied or inserted at or near one end—say, the top C—of the box, and withdrawn or discharged from the other end, which, in this case, would be at the bottom D. The end C where the grids are inserted is the one at which the gas leaves, as by the outlet pipe F; while the end D from which the grids and the purifying substances they support are discharged is the one at which the gas enters, as by the inlet-pipe G. By these means, the most impure gas is firstly subjected to or treated by the most spent purifying substances, gradually coming in contact with the pure or fresh substances as it progresses through the apparatus; the last it is in contact with being the most recently added. Instead of the series of holders or grids for the purifying substances being placed one above another, it may be possible to arrange them in lateral contiguity with each other; or, again, they may be fixed at an angle to the vertical plane. But in either of such methods, the apparatus is not so easily made use of as when arranged as hereinbefore described. In order to enable the grids and purifying substances to be added and withdrawn, a cover cr door H is provided at the top, and another K at the bottom, of the boxes; and these covers or doors are secured by the clamping-pieces, so that a perfectly gas-tight joint is formed between them and the walls of the boxes. To supply grids and purifying substances at the top of the boxes, a hoist P is used, which is arranged to raise the grids from the ground-level to the space above, where they are laid hold of by the chain or hook of the lifting-block or crane Q travelling on the beam or girder R, so that such grids may be moved and placed where desired. By the same hoist the moveable hopper S is also raised after it has been filled with the purifying substances at the ground-level; and this hopper is made to travel upon the beam or girder R, in order that its contents may be deposited in one or other of the boxes A, as the case may be.

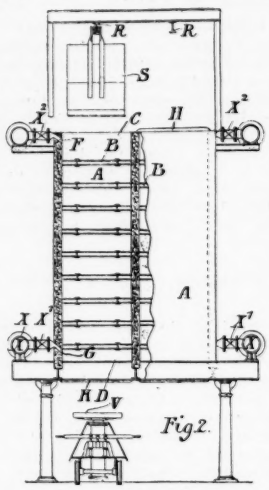


Fig. 2.

For removing the grids and the purifying substances which they support, the carriage T is used, upon which are mounted the hydraulic or other lifting-jacks U and V; and this carriage travels beneath the boxes until its jack V is beneath that from which the grids have to be removed. The jack is then raised sufficiently to relieve the door K, to enable its clamping-pieces to be removed, on which the jack is lowered, bringing with it the door. The carriage is then moved so that its jack U is brought beneath the grids in the box, on which it is raised to lift the whole series of grids, or such of them as will free the holding-catches W from the weight of the grids which they support. When the lowest grid has been thus raised clear of the catches, these are rotated by a handle and shaft to such a position that they do not lie in the path of motion of the grids. Thus these may be lowered until the lowest is clear of the catches, on which the latter are again moved into their horizontal position to arrest the descent of the grids, so that in this case only one of them and the purifying substance it supports has been allowed to be withdrawn. The door K is then replaced, so that when the valve X^1 of the supply-pipe X is turned to admit gas to the chambers A on the exit-valve X^2 being opened, the gas commences to flow as desired.

APPLICATIONS FOR LETTERS PATENT.

8196.—Francis, A. S., "Gas-burners." April 8.
8202.—Pike, I. W., "Cooling coke." April 8.
8248.—Zimmer, E., "Automatic ignition of gas." April 9.
8255.—Cheer, E. T., Tees, W., and Ireland, H., "Valves." April 9.
8276.—Rhodes, B. & B, "Pressure valve." April 9.
8284.—Haltenhoff, O., and Kronheim, W., "Lighting apparatus for gas and incandescent lamps." April 9.
8287.—Brunck, R., "Extraction of ammonia from distillation gases." April 9.
8412.—Wieser, E., and Schlaich, H., "Distant lighting of gas-lamps." April 14.
8477.—Foulis, W., "Charging retorts." April 14.
8478.—Swan, J. W., and Kendall, J. A., "Manufacture of cyanides." April 14.
8490.—Burger, L. F., "Gas-engines." April 14.
8495.—Robinson, M. H., "Gas-engines." April 14.
8511.—Young, W. F., "Gas-heaters." April 14.
8651.—Friedrich, A., "Gas-burner regulator." April 16.
8671.—Theisen, E., "Centrifugal apparatus for treating gases." April 16.
8680.—Mills, B. J. B., "Gas-stoves." A communication from "Secretary." April 16.
8699.—Yerrington, H. W., and Emery, W. H., "Gas-burners." April 16.
8741.—Prescott, A. P., "Reflectors and chimneys for gas-burners." April 17.
8757.—Strang, H. C., "Gas-engines." April 17.
8777.—Robinson, M. H., "Gas-engines." April 17.

An issue of £50,000 of 4 per cent. preference stock of the Newcastle and Gateshead Gas Company, for which tenders had been invited, was allotted last Tuesday at an average price of £102 15s. 3½d. per £100 of stock.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The Supply of Cheap Gas for Power Purposes.

SIR,—I am interested in differential prices; and before opening the "JOURNAL" for the 21st inst., I had written the following.

An application for special terms is made to the management of a gas undertaking by a consumer who guarantees a day consumption which will increase the total sale of gas 25 per cent. What offer should be made with the following data?

Cost per 1000 *Cubic Feet of Gas Sold.*

Gas delivered to distributing mains 18d.	= 18·95d.
Repairs, mains, and services	1·03
Inspection	0·26
Collection	0·26
Salaries, directors, auditors, &c.	1·55
Establishment	0·39
Rates and taxes	1 29
Sinking fund and interest or dividend	5·68
Selling price	= 29·41d.
Present unaccounted-for gas	= 5 per cent.
Unaccounted-for gas on additional sale, estimated	= 2 per cent.
Increased rates and taxes, per 1000 cubic feet on additional sale	0·48d.
Increased sinking fund and interest or dividend charges on capital outlay necessitated by additional sale	2·02d.

It is assumed that the cost of gas delivered to distributing mains—viz., 18d. per 1000 cubic feet—cannot be reduced.

ANSWER No. 1.

The new consumer to bear *pro rata* proportion of *all* charges. The unaccounted-for gas will now be (5 per cent. × 4 + 2 per cent. × 1) ÷ 5 = 4·4 per cent.

Cost per 1000 *Cubic Feet of Gas Sold.*

Gas delivered to distributing mains (18d. × 100) ÷ 95·6	=	18·83d.
Repairs 1·03		
Inspection 0·26		
Collection 0·26		
Salaries 1·55		
Establishment 0·39		
3·49		
No increase in these therefore spread over whole 3·49 × 4s. 5d.	=	2·79
Rates, &c. (1·29 × 4 + 0·48 × 1) ÷ 5	=	1·13
Sinking fund and interest or dividend (5·68 × 4 + 2·02 × 1) ÷ 5	=	4·95
		27·70d.

Under these conditions, the selling price to the new consumer = 27·7d. per 1000 cubic feet; and the price to all existing consumers can be reduced to the same figure. The advent of the large consumer benefits the whole of the consumers; the staff outside the works would receive no increased pay; and the additional profit is only just sufficient to cover sinking fund and interest or dividend on the increased capital outlay. The large consumer is considered by some to be a potential danger, as he may at any time, unless under a guarantee for a term of years, stop work, change to electricity, or fail in business, and then the capital outlay on his behalf would be unremunerative. On the other hand, by the general lowering of the price, the gas sales are likely to further increase; and the lower the general price, consistent with earning the sinking fund and interest or dividend charges, the more secure is the undertaking.

ANSWER No. 2.

If it be considered unfair to give the existing small consumers the same low price as the new-comer, the price for the increased sale can be worked out thus:—

Cost per 1000 *Cubic Feet of Gas Sold.*

Increased quantity delivered to distributing main, 2 per cent. unaccounted-for, (18d. × 100) ÷ 98 =	18·37d.
Repairs, inspection, collection, salaries, establishment. No increase on present charges; therefore omit.	—
Rates and taxes	0·48
Sinking fund and interest or dividend	2·02
	20·87d.

Under these conditions, the selling price to the new consumer = 20·87d.; the existing consumers continuing to pay the same as before. As the same disadvantages as mentioned in Answer No. 1 exist, and the whole establishment is being worked without profit or additional pay, simply to turn out more gas at cost price, what advantage does the undertaking derive by supplying the increased 25 per cent.?

If an offer should be made between 20·87d. and 27·7d., will you in a leader, or will some of your correspondents, discuss the considerations that would determine the price?

I am glad Sir George Livesey has raised the question of the justice of these differential prices, and that you have drawn attention to the 1d. a unit bid for power custom now being made by electrical undertakings. Will some of your readers who have offered differential prices state the reasons (with figures) that led them to settle the price offered? I shall also be glad to learn by what arguments and figures can a penny as the *selling* price per unit for electricity for power be justified. The only question, as you state, is "What is the fair tender to make for such business?"

F. J. BANCROFT.

Hull, April 24, 1903.

The Periodicity of Drought and Rain.

SIR,—I have read with considerable pleasure and profit the article on the above subject in your last issue. Many of the notes and suggestions will, I am sure, prove most beneficial to the water engineer. Few of your subscribers can find the leisure to read "The Times," being practical men who rely upon the "JOURNAL" to supply all up-to-date facts. Mr. Clayton Beadle, the Secretary of the Underground Water Preservation Association, is safe from criticism while he sends his contributions to "The Times." He states that the present shortage of water available for supply is caused by "excessive pumping;" and the inference is, solely by the London Water Companies. On reading the evidence of experts examined before Lord Balfour's Commission in 1892-3, however, this statement is not fully proved as regards the level of the underground water. It is also stated by one of the leading engineers of thirty years' experience that the flow of the Thames was not affected by the pumping carried on by the Water Companies. He was asked (question No. 2190) as to the level of the water depending entirely upon the regulation of the lock and weir at Molesey; and he replied: "The water always keeps up to the level of the weir, notwithstanding all our operations." Therefore, to account for the lowering of the underground water level and the flow of the Thames, the diminution in the annual rainfall must be first of all considered.

This, indeed, is the most useful and interesting part of the question now before us—viz., the rainfall and the variations of climate on these islands. The successors to the late G. J. Symons assert that the conclusions drawn from the whole of his records "do not support any definite cycle or periodicity." It would be most helpful to many water engineers if you could procure and publish the accurate records of rainfall kept by the Water-Works Engineers of Leicester, Southampton, Cardiff, and Torquay, which possibly may throw some light on the question of the periodicity of drought and rain. They would certainly show the cycle of precipitancy. It would be very beneficial to many of your readers if some water engineers would communicate the dates of the recurring wet periods; for some of these records will probably exhibit remarkable coincidences with the "Brückner cycle." By comparisons of many accurate and well-known water-works records, we shall be able to make deductions helpful in determining the periodicity of drought and rain, which will be most profitable to water engineers, as well as to many other readers of the "JOURNAL."

INSPECTOR.

April 24, 1903.

Gas Manufacture for 1903 at the Old Kent Road.—Mr. W. Woodward writes, with reference to the description of the latest South Metropolitan carbonizing practice which appeared in last week's "JOURNAL," to say that the work is not altogether novel, although meritorious. At Bromley there have been, for the last eight years, outside producers in connection with the No. 1 retort-house; each producer providing gas for 96 retorts. The system of inclined grate-bars, too, has been used there exclusively for ten years, and so also has the forced draught to the producer; the only difference being that at Bromley the draught is forced by a Meldrum blower.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

The House re-assembled last Tuesday, after the Easter recess; and during the week the following further progress was made with Bills:—

Bills read the third time and passed: Broadstairs Gas Bill, Burgess Hill and St. John's Common Gas Bill, Ipswich Gas Bill, Maidstone Gas Bill, Market Drayton Gas Bill, Sutton District Water Bill.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Saturday, April 25.

(*Before Mr. Justice* SWINFEN EADY.)

"Pilot" Gas-Mantle Company v. A. A. Haigh and Co.

Mr. MANSFIELD said in this case he had to move, on behalf of the plaintiffs, who are established in Bolton, for an injunction to restrain the defendants, who trade in Sheffield, from carrying on business as manufacturers or vendors of mantles under the name of the "Pilot" Gas-Mantle Company, or under any name so contrived as to represent or lead to the belief that the business so carried on was in any way connected with that of the plaintiffs, and from using the word "Pilot" in any other manner calculated to lead to such belief. He had also to ask that the defendants might be restrained from selling mantles not of the plaintiffs' manufacture under any name containing the word "Pilot," or under any other name which, by reason of colorable imitation, was calculated to represent or lead to the belief that such mantles were of the plaintiffs' manufacture. The principal defendant did not appear, and he had written to say he could not do so unless the plaintiffs paid his expenses. The plaintiffs commenced business in 1901 as manufacturers of incandescent mantles and accessories, and had agents in every large town in England. In Sheffield, they had two principal agents and 50 sub-agents; and the mantles which the defendants had been selling were almost identical in box and label with those sold by the plaintiffs. When Mr. Haigh was communicated with, he

said he was not the manufacturer, and had only sold mantles supplied to him by other persons.

His LORDSHIP asked if Haigh had been requested to give the names and addresses of the persons who had supplied him.

Mr. MANSFIELD said he had not; the matter had not been further investigated.

His LORDSHIP said the plaintiffs were entitled to an interim order; but they ought to make inquiries, especially as to the names and addresses of the persons from whom the defendants purchased.

Mr. MANSFIELD agreed that this seemed to be necessary.

His LORDSHIP added that when the question of costs came to be considered, one always looked to see if steps had been taken against the real infringers and manufacturers, and not against the small shopkeepers only.

An interim injunction was granted until the trial.

Emitting Steam from a Gas-Works.

At the last Limerick Quarter Sessions, before his Honour Judge Adams, Mr. A. P. Lynch sued the Corporation of Limerick to recover damages for injuries sustained by his pony, which took fright at a puff of steam coming from a pipe which conveyed it from the gas-works and ejected it on the roadway. The pony fell, and broke its knees badly. His Honour, in delivering judgment, said the Corporation, for an outlay of £30, could have conveyed the steam into the main sewer; but this had not been done. The money was wanted for setting up electric lighting works to compete with their own gas-works. The Corporation were good at ripping up roads; but for some mysterious reason they forgot to put them down. The steam frightened some horses, and did not frighten others. His Honour said he had seen the "geyser;" and on a cold day a jet of hot water would produce a very considerable puff of steam. He was informed that it was a terrible nuisance, and a great danger. He gave a decree in favour of the plaintiff for 15 guineas, and 3 guineas to the veterinary surgeon who appeared as a witness.

The Sale of Spurious Mantles.

Last Friday, at the Liverpool City Police Court, several cases of fraud on the Welsbach Company were investigated by Mr. Kinghorn, Deputy Stipendiary Magistrate. The summonses were of a somewhat similar character to those recently taken out by the Guaranty Incandescent Mantle Company, and heard at the same Court (*ante*. p. 98). In the first case, S. M. von Hinden was summoned under the Merchandise Marks Acts for causing to be falsely applied to goods a trade mark so nearly resembling that belonging to the Welsbach Gas-Light Company as to be calculated to deceive. Mr. E. Stewart Brown, who prosecuted, remarked that this kind of fraud was greatly on the increase. The defendant was connected with the S. M. von Hinden Electrical Company, which was in liquidation; and one of the points of the defence, he understood, was that the fraud, if committed, was not committed by himself, but by the Company. The mantles came from Germany, and bore the Welsbach Company's trade mark. On arrival in England, they were placed in boxes and labelled similarly to those of the Welsbach Company—they were, in fact, sold as Welsbach mantles all over the place. An enormous number of these cases, together with a quantity of labels, were found at the defendant's warehouse. For the defence, it was urged that the case failed, as the prosecution had not proved that the defendant was a member of the firm in question. Mr. Kinghorn, however, replied that there was evidence of this. Another summons was heard against the same defendant in respect to "Sunlight" mantles; and, in the result, fines of £10 and costs were imposed on each information. Subsequently, William Skelkes, the defendant in the Guaranty Company's case reported by us a fortnight ago, was mulcted in a fine of £20 and costs for a similar offence with regard to the Welsbach Company.

Improved Lighting at Newcastle.—The City Lighting Committee of the Newcastle Corporation have decided to erect 37 self-intensifying incandescent gas-lamps in Shields and Scotswood Roads, at an additional cost of £194 per annum. These lamps will give an illuminating power of 24,300 candles. In Shields Road, there will be 17 new lamps, which, instead of giving, as at present by those in use, 920-candle power, will furnish a light of 14,400 candles. The erection of similar lamps is contemplated in other parts of the city.

West's Combined Charging and Drawing Machine.—This latest development of West's Gas Improvement Company is finding much favour with gas engineers. We hear that orders have been recently placed with the makers for complete installations of stoking machinery, including the new combined charging and drawing machines and the necessary coal-handling machinery, by the Ipswich Gas Company, and by the British Gaslight Company, Limited, for their Norwich and Potteries stations. At the Norwich Gas-Works, the coal-handling machinery includes coal elevating and conveying machinery for the loading of barges.

Results at Ripon.—In his first annual report to the Gas Committee, Mr. W. T. Lancaster, the Gas Engineer and Manager to the Ripon Corporation, states that the total amount of gas made during the past twelve months was 39,274,400 cubic feet, from 3797 tons 16 cwt. of coal and slack—making an average yield of 10,344 cubic feet per ton of coal and slack carbonized. The amount of gas sent out was 39,284,220 cubic feet; the total quantity sold and accounted for being 23,490,050 cubic feet, or 8818 cubic feet per ton of coal and slack carbonized. The total amount of gas lost was 5,786,170 cubic feet, or 14·72 per cent. For the twelve months ending March 31, 1902, the total amount of gas made was 38,849,000 cubic feet, from 4336 tons of coal, yielding an average of 8876 cubic feet per ton. Mr. Lancaster looks for a considerable reduction in the leakage over the next twelve months, as a result of the extensive repairs to the mains, &c., which were recently undertaken.

MISCELLANEOUS NEWS.

PARIS GAS COMPANY.

Report and Accounts for the Year 1902.

The following is an abstract translation of the report of the Director of the Paris Gas Company on the working of the undertaking in the year ending Dec. 31 last, with the principal items in the accounts.

In the twelve months which closed on the above-named date, there were sent from the Company's works 335,418,788 cubic metres, or about 11,840½ million cubic feet, of gas, compared with 335,803,091 cubic metres, or about 11,854 millions, in the previous year; being a decrease of about 13½ million cubic feet. In the day consumption, there was an increase of 3,585,740 cubic metres, or close upon 126½ million cubic feet, due to the more general use of stoves, engines, &c. The revenue from the sale of gas amounted to 88,746,824 frs. (£3,549,873), or 1,864,684 frs. (£74,587) more than in 1901. This apparent anomaly is explained by a diminution in the public lighting last year (gas for which is charged at a reduced rate), while there was an increased supply to the private consumers. Of the total receipts, 80,591,147 frs. came from the city, and 8,155,677 frs. from the surrounding districts. The total number of consumers at the close of the year was 491,193, compared with 473,656 at the end of 1901. They were divided into two classes: Ordinary, 308,806; and "free fitting," 182,387. In the previous year the numbers were 300,720 and 172,936. Consequently, there was an increase of 8086 in the former, and of 9451 in the latter class, or a total of 17,537.

The number of burners in the public lamps on Dec. 31 last was 66,202, of which 53,531 were employed in lighting the city and 12,671 were in use in the suburbs; being an increase of 2208—2113 in Paris and 95 outside. The Municipalities displayed considerable activity last year in substituting Auer, Denayrouze, and other burners, for the ordinary jets in the public lamps. The extent to which the different kinds are used is shown in the following table:—

Kind of Burner.	1901.	1902.	Inc.	Dec.
Ordinary	10,204	3,297	—	6,907
Auer	37,028	46,136	9,108	—
Denayrouze	2,992	2,934	—	58
St. Paul	1,104	1,095	—	9
Regenerative	90	69	—	21
Total	51,418	53,531	9,108	6,995

The number of rising mains laid on last year was 1010; bringing up the total to 51,060. The consumers served from them at the close of the year numbered 348,020, or 15,503 more than at the corresponding time in 1901. The proportion of consumers supplied in this way is 70·85 per cent. of the entire body, against 70·20 per cent. before.

With regard to the works and plant, no important extensions were carried out last year; but arrangements were made for the installation of machinery for charging and drawing retorts and the conveyance of materials, for which the Company have taken out patents.* The distributing system was extended by about 15,837 yards—12,108 yards in the city, and 3729 yards in the suburbs. These additions brought up the total length of mains on Dec. 31 last to 2,787,967 yards—1,839,199 yards within, and 948,768 yards beyond the city. There was a net sum of 2,859,540 frs. (£114,382) expended for capital purposes last year; and at the close the account stood as follows:—

	Francs.	Sterling.
Amount expended to Dec. 31, 1901	332,770,983	£13,310,839
" " during 1902	2,859,540	114,382
Total	335,630,523	£13,425 221

To meet this there has been raised: By shares, 84,000,000 frs.; by bonds, 254,004,189 frs.—together, 338,004,189 frs. To this total must be added a sum of 2,246,799 frs. taken from the revenue in 1900 to meet capital expenditure in excess of 3,200,000 frs.; making in all 340,250,988 frs. (£13,610,039). There is consequently an unexpended balance of 4,620,465 frs. (£184,818). The capital is represented by 336,000 shares and 553,332 bonds. At the date of the report, there had been redeemed 279,492 shares and 435,317 bonds; so that 56,508 shares and 118,015 bonds remain for redemption.

The following is the working account for the past year:—

Expenditure.

	Francs.	Sterling.
Value of gas in store on Jan. 1, 1902	61,730	£2,469
Manufacture of gas—		
Coals carbonized	23,139,003	925,560
Coke and tar for heating purposes	4,726,199	189,048
Salaries and wages	5,094,522	203,781
Maintenance of works and plant	1,827,509	73,100
Incidental expenses of carbonization	1,401,541	56,062
Purifying materials and labour	334,524	13,381
Distribution—		
Salaries of Engineers and officers	2,856,909	114,276
Repairs, &c., of mains and services	1,967,308	78,692
Miscellaneous expenses, stamps, &c.	477,162	19,087
Gratuitous installations of fittings, &c.	761,752	30,470
General management (including interest and sinking fund payments)	26,229,529	1,049,181
Pension and provident funds	2,021,657	80,866
Municipal charges—		
Tax of 2 c. per cub. met. of gas sold	5,790,766	231,631
Rent of subsoil occupied by mains, &c.	200,000	8,000
Lighting, extinguishing, and maintenance of public lamps (less amount paid by Municipality)	1,394,977	55,800
State charges—		
Official gas testing, stamps, &c.	1,217,504	48,700
Total expenditure	79,502,592	£3,180,104

* The appliances referred to have been described in the "JOURNAL." (See Vol. LXXX., pp. 1630, 1631, 1694; and Vol. LXXXI., p. 38.).

Revenue.

	Francs.	Sterling.
Value of gas in store on Dec. 31, 1902	64,029	£2,561
Sale of gas	88,746,824	3,549,873
Residual products—		
Coke	16,891,601	675,664
Tar	1,591,759	63,671
Ammoniacal liquor	1,765,384	70,615
Rental of meters and fittings on hire	2,379,433	95,177
Interest and discount	1,166,751	46,670
Total revenue	112,605,781	£4,504,231
Deduct expenditure	79,502,592	3,180,104
Balance, profit for 1902	33,103,189	£1,324,127
Add balance from 1901	168,788	6,752
	33,271,977	£1,330,879
Deduct to meet outstanding claims	471,977	18,879
Balance available for distribution	32,800,000	£1,312,000
Deduct for share dividend	11,200,000	448,000
Balance, divisible equally between the Company and the Municipality	21,600,000	£864,000

The total amount coming to the shareholders is therefore—

	Francs.	Sterling.
Dividend as above	11,200,000	£448,000
Half of divisible balance	10,800,000	432,000
Placed to shareholders' credit, as per resolution of March 23, 1875	50,000	2,000
Balance of undivided profits	288,779	11,552
Total	22,338,779	£893,552
Deduct 1 fr. per share for reserve fund (336,000 frs.) and the complement of the share redemption fund ordered by the State Council to be borne by the shareholders (3,280,292 frs.)	3,616,292	144,652
Balance	18,722,487	£748,900
Deduct interim dividend of 12 frs. 50 c. per share paid in October last	919,737	36,790
Balance	17,802,750	£712,110

This allowed of the payment of a final dividend of 52 frs. 50c. per share, making 65 frs. for the year; leaving a balance of 162,749 frs. (£6510) to be carried forward. The dividend was 1 fr. per share higher than that declared last year, which was 3 frs. more than in 1900.

Following the accounts is the portion of the report dealing with the residual products and the gas-stove business. The revenue from the sale of coke was 2,533,742 frs. (£101,350) less last year than in 1901, owing to the mild weather; while tar and chemical products dropped to the extent of 136,287 frs. (£5451). The Company's show-rooms were well patronized; and orders were received for about 7000 heating and cooking appliances. At the close of the past year there were in use in the Company's district 3527 gas-engines, of a total capacity of 15,584-horse power; being an increase of 146 engines and 1154-horse power.

Particulars are, as usual, furnished in regard to the Company's provident, pension, and savings funds. Last year the expenses of the provident fund amounted to 552,867 frs. (£22,115), whereas the receipts were only 427,427 frs. (£17,097); leaving a deficiency of 125,440 frs. (£5018), which was charged to the year's working. There are two pension funds—one for the workmen and the other for the clerks, &c. The amount of the former at the close of last year was 1,334,065 frs. (£53,363), and of the latter 13,429,545 frs. (£537,182). Portions of each of these funds are invested in Company's shares and bonds. The balance of the savings fund at the close of the year was 306,834 frs. (£12,273).

The report concludes with an account of the circumstances under which the price of gas was reduced, as from the beginning of this year, to 20c. per cubic metre, and a *résumé* of the negotiations between the Directors and the Gas Committee of the Municipal Council, in connection with the new concession, down to morning of the meeting (March 26). The result of these and later proceedings on this matter has been recorded in recent issues of the "JOURNAL."

GAS, ELECTRICITY, AND WATER IN MANCHESTER.

The Past Year's Working.

The accounts of the Manchester Gas Department for the year ended March 31 show a gross profit of £226,796 and a net profit of £137,286—or over £57,000 more than was expected. The estimated profit for the year was £80,134. More than £20,000 has been saved on the cost of coal; and besides this there has also been a considerable gain in regard to other matters. The consumption of gas has been slightly below the record of the preceding year. The falling-off was in the first three months of 1903; up to Christmas there was an actual increase. This decline is attributed to the exceptional mildness of the second half of the winter, and the absence of fogs. There was, however, a substantial increase in the number of consumers. The satisfactory result of the year's trading is owing to the reduced cost of coal, to economical working, and to the high receipts from the sales of residual products. Coke, tar, and sulphate of ammonia have been in great demand throughout the year; and full advantage has been taken of the high prices which have ruled. For the year ending March 31, 1904, the Committee estimate the expenditure at £668,425, and the net profit at £52,575, out of a total income of £721,000. They propose (subject to the approval of the City Council) to reduce the price of gas to ordinary consumers by 3d. per 1000 cubic feet—from 2s. 9d. to 2s. 6d. within the city, and from 3s. to 2s. 9d. without—as and from June 24 next, and to abolish at the same time the quarterly charge for the hire of gas-cookers. These changes represent an annual saving of £61,000 to the ordinary consumers. After allowing £50,000 to go to the city fund in relief of the rates, there is a surplus of £87,286 on the past year's working. This, with the estimated net profit of the current year (£52,575), makes £139,861; and the Committee propose to give next year £50,000, as usual, in relief of the rates, to spend £13,000 on extension of works, and to carry forward the balance (£76,861) to the contingent fund. The Committee estimate that in the next year they will receive £600,000 from the sale of gas (including £43,300 for the public lamps), £65,000 from coke, £25,000 from tar, and £30,000 from sulphate of ammonia. Since the gas undertaking passed under the control of the Corporation in 1844, the sum of £2,559,301 15s. 11d. has been taken out of the profits and applied in aid of the city rates. Gas used in engines will continue to be charged for at the rate of 2s. per 1000 cubic feet; and for slot meters the price will remain at 1d. for 30 cubic feet, inasmuch as the price was not raised to this class of consumers when the charge to those using ordinary meters was raised 3d. per 1000 cubic feet.

With regard to the Electricity Department, the estimated expenditure for the past year was £175,459, and the approximate expenditure £188,828; while the estimated income was £166,447, and the approximate income £189,266. For the year ending March 31, 1904, it is estimated that the expenditure will be £242,450, and the income £233,000—leaving a loss of £9450 to be met out of the reserve fund. The amount to be raised in the current year's rate for street lighting is £400, as compared with an outlay of £500 for this purpose last year; but, on the other hand, the Committee expect to receive during the current twelve months from sales of current to the Tramways Department £81,250, as against £47,466 in the past year. The total estimated expenditure on capital account for the current year is £350,600, as compared with an approximate outlay during the twelve months to March 31 last of £626,959.

The Water Committee have resolved to recommend the Council to levy a domestic rate of 8d. in the pound, and a public rate of 1d. in the pound for the year ending April 1, 1904. These rates are the same as have existed for some years past, although the work of laying the second pipe from Thirlmere is proceeding at a total estimated cost on capital account of over £500,000. The total income of the department last year was £306,669. There was a balance of £202,688; and as payments amounting to £219,219 had to be made on loans, annuities, consolidated stocks, sinking fund account, &c., there was a deficiency of £16,530. Connections were made to 5262 additional houses and other premises, by means of over 4¾ miles of service piping. A full supply of water was continued throughout the year. The minimum charge for supplies of water by meter for trade purposes outside the city has been advanced, in accordance with the decision of the Council, from 4·85d. to 6d. per 1000 gallons.

SOUTHPORT CORPORATION GAS SUPPLY.

Extension of the Water-Gas Plant.

At the Meeting of the Southport Town Council last Tuesday, the minutes presented by the Gas Committee contained a paragraph recommending that tenders should be obtained for two additional units of carburetted water-gas plant. The adoption of the minutes having been moved by Mr. E. Trounson, the Chairman of the Committee, Mr. Baker proposed, as an amendment, that the matter be referred back. He said the works as they stood at present could produce about 800,000 cubic feet of gas per day, and the suggested new plant would cost from £4000 to £6000, which he thought would be a dead loss to Southport. Mr. Ashton seconded the amendment. He said it was stated four years ago that Southport had one of the best designed water-gas plants in the country; and at that time they were making 27 million cubic feet less gas than now. The movement in the direction of supplying better and cheaper gas was not in the extension of the water-gas system. Alderman Griffiths pointed out that if it had not been for the water-gas plant already erected, the gas profits would have entirely ceased years ago. Instead of £9000, there would not have been a penny. By the provision of this plant a capital expenditure of £50,000 or £60,000 had been saved. They had lately agreed to carry out their expert's advice. The manufacture of gas was now in the proportion of one-third of water gas to two-thirds of the ordinary kind. By the expenditure of £6000, they would be in a position to get the quantity required for some years, and practically would not affect the capital account, which now stood at £265,000. Mr. Trounson having replied, the amendment was put and lost, and the minutes confirmed.

THE PUBLIC LIGHTING OF BLACKPOOL.

Alderman Mather on Incandescent Gas v. Electricity.

In the "JOURNAL" for the 14th inst., reference was made to the above subject, in connection with some remarks by Alderman Mather, the Chairman of the Markets and Lighting Committee of the Blackpool Corporation, at a sitting of the Town Council on the previous Tuesday, on the enormous cost of lighting the town. The Alderman is determined to keep this matter before the ratepayers, for he has followed up his protest in the Council by an article in a local paper, in which he brings before them some comparative figures which will possibly come rather as a surprise. When Blackpool became a pioneer of electric lighting in 1893, there was no competitive light in the field. Now, however, electricity has been superseded by intensified gas. The town is spending £12,000 a year on lighting, because it has been pledged to electricity; but Alderman Mather contends that, if advantage is not taken of the newest inventions in the use of coal gas, the ratepayers' money will be wasted, and the Corporation will lose ground as a wide

awake, progressive Municipality. The Gas Committee at present make a profit of 15 per cent. out of the public lighting. The Alderman considers this is not right. He thinks gas and electricity ought to be supplied for street-lighting purposes at not more than 5 per cent. on the cost price.

Alderman Mather next proceeds to give his comparative statement, as follows: "The capital invested in gas-lamps is £6553, and the annual charge on this may be set out at £327. In electric lamps the capital invested is £14,054, and interest and maintenance amount to £959. The charge for lighting with gas is £2 3s. 4d. per lamp per annum (or ½d. per hour). The average cost of each arc lamp per annum is £21, and of each glow lamp £2. The great increase in the expense of public lighting has come about since 1897. In that year, the cost of gas lighting was £3739, and that of electric lighting £2711 —making a total of £6450. In 1902, the cost for gas went up to £5945; but the cost for electric light has more than doubled, the figure being £5958—making a grand total of £11,903. This represents a total increase in public lighting of 84 per cent. During that period, the increase in the rateable value of the town was at the rate of 51 per cent. Gas is used for the lighting of 84,000 yards, or 50 miles, of main streets; and this requires 1774 lamps. There are also 202 gas-lamps in back streets. The computation, therefore, is that lighting by gas costs 1s. 3d. per yard per annum. Electric light covers 14,300 yards by 263 arc lights, and 1200 yards by 290 glow lamps. This works out at the large sum of 7s. 8d. per yard. This comparison, I think, will be generally regarded as astonishing."

Comparing the lighting of various streets in the town, Alderman Mather shows that great discrepancy exists—some of the thoroughfares being much over-lighted. He says: "The electric light is very costly, and the arc lamps are at so great a height that the light is not nearly so powerful as it is represented to be." He cites a glaring case of inconsistency in public lighting in two roads on the South Shore. One measures 450 lineal yards, and is lighted by six arc and 24 glow lamps at a cost of £174 annually; while the other, with 433 yards lineal, is lighted by double-burner gas-lamps at a cost of £32 3s. 4d. The difference in cost is therefore £140. Another road (400 yards long) only costs £36 16s. 8d. a year for gas lighting. In the centre of the town an interesting comparison is afforded between two roads, respectively 533 yards and 600 yards long. The former is electrically lighted at a cost of £168; the latter is lighted by gas for £54 10s. Other discrepancies are cited, bringing up the total cost of electricity to £668, against £140 16s. for gas; being a difference against the former of £527 4s. Two streets on the South Shore now cost £300; but if they were lighted by the new incandescent gas-burners, they would cost only £112. Alderman Mather points out that this comparison holds good throughout the town. All the figures he has given go to show that the cost of electric lighting is very heavy in proportion to that of gas; and it has been proved by experiment in various parts of the town that the lighting by the incandescent gas system is adequate in illumination, and, moreover, is economical.

Having called attention to what has been done in Liverpool and Manchester in the way of incandescent lighting, in answer to the complaint that the Blackpool Lighting Committee are taking a retrograde step in adopting this system, Alderman Mather refers, in conclusion, to the experiment which is to be made in the course of the next few weeks in the illumination of the Market by the Keith light. The proprietors are putting in an experimental installation, so that the Corporation may satisfy themselves as to whether the light is equivalent to, or better than, the present electric installation, which last year cost the large sum of £65 3s. 10d. He says: "From what I have seen of the new light at Bolton, Manchester, and other places, I am satisfied that we shall effect a very great saving. . . . The light is of better quality, and there is a much better diffusion with a great reduction of the contrasting light and shadow which has been a source of great complaint in our Market buildings. The light is perfectly steady. . . . The economies which the Lighting Committee propose to carry out by restricting the hours of lighting will reduce the annual charges by something like £1700; but this is a small amount by comparison with the saving to be effected by a general adoption of a system of incandescent and intensified gas lighting."

PRIMITIVA (BUENOS AYRES) GAS AND ELECTRIC LIGHT COMPANY, LIMITED.

The Annual General Meeting of this Company was held last Tuesday, at the London Offices, No. 2, Bank Buildings, Princes Street, E.C.—Mr. H. E. Jones in the chair.

The Secretary (Mr. J. H. Bouwer) having read the notice convening the meeting, the Directors' report and the accounts were taken as read.

The Chairman at once proceeded to give an explanation of the accounts. He said the shareholders would be pleased to notice, from the profit and loss account, that the balance from the revenue account was £103,251, which compared with the balance last year of £80,444 —being practically an increase of £23,000. From this balance, as would be seen, they had paid the interest on debentures, amounting to £16,783. It would also be observed that (this was only the second year of the Company's existence) there was a charge of £1175 for sinking fund for the redemption of the debentures, because, under the Articles of Association, only six months came into the past year; but, of course, in the future, the item would be double this amount. It would also be remarked that "commission, discount, and interest" was £4172, as against £7300 in the preceding year, so that in this respect an economy was shown. The item of London office expenses (£4796) was hardly worth discussing; and the income-tax paid and accrued (£5410) was about the same as in the previous year. Then he came to a new charge, which gave the utmost satisfaction to the Directors, and he thought it would also to the shareholders. That was, the item for depreciation on electrical works and machinery, £8664, and furniture, £262—making together £8926. Dealing with this question of depreciation, the Directors had long and frequent discussions with the Auditors. Reference was then made to the amount of depreciation generally charged by electrical undertakings; and he was bound to say that he looked upon this with extreme satisfaction, as it was rather the exception than the rule to allow depreciation at all. But certain very prosperous electrical undertakings in London—and he was sure the shareholders would agree with him that this would be a very profitable thing for those undertakings in the future—had charged an average of about 3 per cent. in the shape of depreciation for several years past; and the amount they had themselves charged (£8663) had been calculated on that basis. Then the Directors had thought it was about time they dealt with the figure of above £40,000 which attached to the issue of the loan—discount and other expenses—and they had, after a good deal of discussion, decided to write that off. This year they had charged on this account £2500; and at this rate the amount of those expenses would be extinguished in about fifteen years. One of the other companies had approached this question on a bolder basis, and had written off a larger amount; and, in their own case, they hoped to be in a position in the future to dispose of even greater fractions of the balance. This explained three of the items, amounting to nearly £13,000, which were not in the accounts last year. Going to the balance-sheet, they brought forward to these accounts £12,772, and the profit for the year, after making the charges he had explained, was £59,517—making together £72,289. Deducting the dividend on the preference shares, amounting to £40,000, left £32,289; and this brought them to the consideration of the dividend on the ordinary shares. After giving very long and serious consideration to this point, the Directors determined that it would be, in the long run, to the interest of the shareholders to set aside a round sum for reserve fund, and a sum which might be a precedent, and not too difficult to follow in succeeding years; and so they had adopted the figure of £10,000. This left them with £22,289, out of which the dividend recommended of 3 per cent. on the ordinary shares would exhaust £12,000, leaving £10,289 to be carried forward. Now, with regard to this dividend, he thought perhaps some of the shareholders would think the Directors might have been a little more liberal, seeing that they had, owing to the good management of the past year, a larger balance in hand. But they could not help reflecting that 3 per cent., when nothing was paid last year, was a very satisfactory dividend to pay, and a very considerable jump in the history of the undertaking; and, although there were signs of improvement in management, in the cutting down of expenses, and in the development of the business—for gas was developing at the rate of 6 per cent., and electricity at the rate of some 3½ per cent.—they believed they were acting prudently. He would not prophesy, but he would simply say the Directors hoped to be able—and he should be disappointed if they were not—to add a trifle next year to that dividend. However, they did think that for the present year it would be to the interests of the shareholders generally to declare a dividend of 3 per cent. With regard to the working of the undertaking, the Directors had found it necessary to make certain changes in the staff; and they had sent out to assist Mr. Anderson (who went out the previous year) a very competent Gas Engineer from the works of the South Metropolitan Gas Company, which was under the care of Sir George Livesey, and was well known to be a most successful undertaking. The name of their new Assistant was Mr. Browne. He had had to meet the difficulties of language and of dealing with foreign workmen. But he had prevailed over these; and they had received from the Local Directors and Mr. Anderson the highest approval of Mr. Browne's treatment. Both Mr. Anderson and Mr. Browne had made their influence felt to the extent that there had been considerable savings in the administration. He (the Chairman) would deal with a few of these. He would not weary the proprietors by going through them all; and he would only refer to those connected with the gas undertaking, leaving Mr. Kincaid, in seconding the report, to allude to those touching upon the electrical department. On the latter point, he would only say this, that, within the last six months, he had met Mr. Lewis T. Wright, who, until a few years ago, filled the position of Engineer and Manager of one of the larger gas-works in Buenos Ayres, and was a long while there. Mr. Wright was now working a mountain copper company on the western coast of America; but he volunteered the opinion that it was an extremely wise thing to have an electrical supply in Buenos Ayres, as he had never seen a field which at once admitted of the profitable development of both gas and electric lighting more than Buenos Ayres. This came from a man who was saturated with what he might call gas prejudice; and the shareholders might take it, as the Directors did, as being a most satisfactory assurance of the wisdom of their policy in this regard. As to the manufacture of gas, they had saved, in the course of the year, a sum of about £18,000; but on the distribution of the gas, they had not saved quite so much. Mr. Anderson saw his way to introducing domestic gas appliances—such as stoves for heating and cooking, Welsbach burners, and other things; and these had necessarily called for rather a larger outlay. The other changes were not material; but altogether in the gas department alone, they had improved the net balance by something like £17,000 out of the £23,009 that the Directors referred to in the report. These things were extremely satisfactory. Without further remark, he moved the adoption of the report and accounts, and the declaration of a dividend at the rate of 3s. per share on the ordinary shares, payable free of income-tax, which, added the Chairman, meant a little extra bonus to the shareholders.

Mr. J. Kincaid, in seconding the motion, said, in compliance with the Chairman's request, he would say a few words regarding the electrical undertaking. He might remark, without going into details, which it would be injudicious to give considering the amount of competition there was in this work in Buenos Ayres, that the power station which they had there was situated in the best possible position that it could be in. It was in the centre of the electricity consuming district—among the largest customers, which, it must be admitted, was a most satisfactory position for the power station of an electric lighting company. The power they had installed there was equal to about 2800 kilowatts, which was ample, not only for the existing consumption, but for a large increase. They had had

a considerable addition to the consumption from the station; and the Directors looked forward to being able to supply at a lower price than at present, because, having such ample power, they would be able to lessen the cost price as the supply increased. The alterations that had been made during last year were principally the completion of the additions to the machinery that were ordered before the year—in fact, before the present Directors commenced their duties. The carrying out of the additions had been done in a most satisfactory manner; and the staff in Buenos Ayres had responded well to the desires of the Directors in reducing the cost of the electricity, and in supplying it satisfactorily to the consumers.

The CHAIRMAN said he might have added to his remarks that he had just received a cablegram from Buenos Ayres, saying that the progress of both the gas and electrical supply up to date in the current year showed the same improvement and the same additional profit as in the past year—in fact, a further profit.

Mr. J. N. LAWRENCE asked to what percentage extent the Company could increase the electric lighting in Buenos Ayres from the present plant, without extra expense.

Mr. KINCAID: Over 25 per cent.

The motion was unanimously adopted.

On the proposition of the CHAIRMAN, seconded by Mr. KINCAID, the retiring Director (Mr. W. W. Phipps) was re-elected; and subsequently the Auditors (Messrs. George A. Touch and Co.) were re-appointed.

RIVER PLATE GAS COMPANY.

The Annual General Meeting of this Company was held last Wednesday, at River Plate House, Finsbury Circus, E.C.—Mr. A. E. BOWEN in the chair.

The SECRETARY (Mr. Ernest Heald) read the notice convening the meeting; and the report and balance-sheet were taken as read.

The CHAIRMAN remarked that the Directors were very pleased to be able to give the shareholders such a very satisfactory statement of affairs—especially in view of the circumstances which obtained in Buenos Ayres last year. They might recollect that, when last he had the pleasure of addressing them, there was a great deal of commercial depression in the city, and that the consumption of gas had fallen off owing to the Municipality, as well as the private consumers, having had to economize in every possible way. This condition of affairs continued almost all through the year, though it was expected that a great improvement would take place after the settlement of the international questions which had been under discussion for so long. Even after the settlement was arrived at, it was only towards the end of the year, when it was seen that a record harvest of wheat and linseed was in prospect, that things took a turn for the better. He was glad to say that since the accounts were made up there had been a very decided improvement, and that the Company had done extremely well from January to date. Each month of 1902 showed a slight reduction in the sale of gas as compared with the preceding year; and though this reduction only amounted to 5 per cent., they might remember that 1901 also exhibited a falling off to a similar extent. Last year, therefore, they sold 10 per cent. less gas than in 1900. He, however, felt confident that they had now turned the corner in this respect; and he should be surprised if in twelve months' time he was not able to record a very considerable increase in sales. They gained on balance during the past year 1675 new customers; and the mains were extended by no less than 16 miles, so that the Company had now an enormous network of 389 miles of mains. These additional house services were bound to have a very good effect on the sales. He had once more been asked by some of the shareholders whether the falling off in the consumption was not caused by the competition of the Electric Lighting Companies. Undoubtedly electricity had done them some little harm; but he was again able to tell the shareholders that the number of consumers lost through this cause was very small—only 23 last year. In the centre of the city electricity was very generally used, though it was so costly that many people had gone back to gas. There was no electric lighting competition of any importance in the suburbs, where the Company had recently been pushing out their mains. They had within the last year or so greatly improved their system of incandescent lighting; and the new intensified burners gave a very much better light than electric lamps at less than half the cost. To the very general use of this incandescent light in Buenos Ayres, the Board attributed most of the falling off in the volume of gas delivered to the consumers, because, of course, the new burners only took about 46 per cent. of the gas required for the old flat-flame burners. The Directors were now busily engaged in pushing the sales of gas cookers and stoves of all kinds; and they felt pretty certain of a good result in this direction. The cost of coal last year was very considerably lower than in 1901; and he was glad to say that they had been still more fortunate in the current year, as they had been able to ship a large part of their requirements over the twelve months at even lower figures than in 1902. The oil for the water-gas plant also cost them less; but they had been obliged to temporarily give up the manufacture of this gas, because the Customs Office authorities had detained a large shipment of oil belonging to another Company, and wished to levy a prohibitive duty on it—somewhere about £8 per ton. Of course, it would all come right in time, because there was really no reason for gas oil paying duty any more than gas coal; but until the matter was adjusted, they were obliged to discontinue the use of the oil. The most satisfactory part of the past year's working, was the very good increase in the yield of gas per ton of coal, and also per ton of oil. They had never done so well in the history of the Company. Of course, he was not going to tell them the exact figures; but he assured the shareholders that they did very great credit to the General Manager and also to the Engineer. This increased yield was mainly responsible for the gratifying figures in the profit and

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 204.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
590,000	10	April 17	10½	Alliance & Dublin 10 p.c.	19—20*	..	5 5 0
100,000	10	,,	7½	Do. 7 p.c.	13—14*	..	5 7 2
200,000	5	Nov. 13	6½	Bombay, Ltd.	5⅝—6⅛	..	5 4 0
140,000	5	,,	6½	Do. New, £4 paid	4¼—4⅜	..	5 9 5
380,000	Stk.	Feb. 26	12	Brentford Consolidated	240—245	..	4 18 0
286,700	,,	,,	9	Do. New	177—182	..	4 18 11
50,000	,,	,,	5	Do. 5 p.c. Pref.	131—136	..	3 13 6
206,250	,,	Dec. 11	4	Do. 4 p.c. Deb.	110—113	..	3 10 10
220,000	Stk.	Mar. 12	10⅝	Brighton & Hove Orig.	209—214	+2	5 0 5
246,320	,,	,,	7⅛	Do. A. Ord. Stk.	151—156	..	4 19 4
460,000	20	Mar. 31	10	British	39—40	+½	5 0 0
100,000	Stk.	Mar. 12	6	Bromley, 5 p.c. "A"	118—123	..	4 17 7
165,700	,,	,,	4½	Do. 3½ p.c. "B"	90—95	..	4 14 9
500,000	10	Oct 15	7	Buenos Ayres (New) Ltd.	10⅝—11¼	+¼	6 4 5
250,000	Stk.	Dec. 30	4	Do. 4 p.c. Deb.	93—95	..	4 4 3
150,000	20	Mar. 12	8¼	Cagliari, Ltd.	23—25	..	6 12 0
100,000	10	Sept. 26	10	Cape Town & Dis., Ltd.	15—16	..	6 5 0
50,000	50	Nov. 3	6	Do. 6 p.c. 1st Mort.	53—55	..	5 9 1
1,375,000	Stk.	Feb. 26	5	Commercial 4 p.c. Stk.	104—107	..	4 13 5
503,750	,,	,,	4⅜	Do. 3½ p.c. ,,	99—102	..	4 13 2
407,812	,,	—	3	Do. 3 p.c. Deb.,,	89—92	..	3 5 3
800,000	Stk.	Dec. 11	8	Continental Union, Ltd.	115—125	..	6 8 0
200,000	,,	,,	7	Do. 7 p.c. Pref.	140—145	..	4 16 7
575,000	Stk.	Feb. 26	5⅛	Crystal Palace Ord. 5 p.c.	115—120	..	4 8 10
60,000	,,	,,	5	Do. 5 p.c. Pref.	120—125	..	4 0 0
106,158	,,	Jan. 15	5	Do. 5 p.c. Deb. Stk.	137—140	..	3 11 5
486,090	10	Jan. 29	10½	European, Ltd.	18—19	..	5 10 6
354,060	10	,,	10½	Do. £7 10s. paid	13—14	..	5 12 6
15,243,200	Stk.	Feb. 12	4⅛	Gas-light and Coke	4 p.c. Ord.	83—85	..	5 3 6
					3½ p.c. max.	85—87	..	4 0 6
					4 p.c. Con. Pref.	106—109	+3½	3 13 5
					3 p.c. Con. Deb.	88—90	−1	3 6 8
2,600,000	,,	,,	3⅜					
3,799,735	,,	,,	4					
4,193,975	,,	Dec. 11	3					
252,500	Stk.	Mar. 12	5	Hastings & St. L. 3½ p.c.	90—95	..	5 5 3
70,000	10	Oct. 30	8	Hongkong & China, Ltd.	15—16	..	5 0 0
3,800,000	Stk.	Nov. 13	10	Imperial Continental	204—207	..	4 16 7
473,600	Stk.	Feb. 12	3½	Do. 3½ p.c. Deb. Red.	100—103	..	3 8 0
165,242	Stk.	Mar. 12	6	Lea Bridge Ord. 5 p.c.	115—120	..	5 0 0
561,000	Stk.	Feb. 26	10	Liverpool United A	219—221	..	4 10 6
718,100	,,	,,	7	Do. do. B	162—164	+½	4 5 4
306,083	,,	Dec. 31	4	Do. do. Deb. Stk.	113—115	..	3 9 7
75,000	5	Dec. 11	5	Malta & Medn., Ltd.	4⅜—5	..	5 0 0
560,000	100	April 1	5	Met. of Melbourne	5 p.c. Deb.	103—107	..	4 13 6
250,000	100	,,	4½		4½ p.c. Deb.	101—103	..	4 7 5
541,920	20	Nov. 13	3½	Monte Video, Ltd.		9⅜—10⅜	..	6 13 4
1,515,892	Stk.	Feb. 20	4½	Newc'tle & G'tesh d Con.		103½—104½	..	4 6 2
376,855	Stk.	Jan. 2	3½	Do. 3½ p.c. Deb.		97—98	..	3 11 5
300,000	Stk.	Nov. 27	8	Oriental, Ltd.		143—148	..	5 8 1
600,000	5	Mar. 31	7	Ottoman, Ltd.		6—7	..	5 0 0

* Ex. div.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
105,005	Stk.	Jan. 15	6⅛	Ply'mth & St'house 5 p.c	127—132	..	4 12 9
851,070	10	Oct. 15	7	River Plate Ord.	11¼—12	+⅛	5 16 8
300,000	Stk.	Dec. 30	4	Do. 4 p.c. Deb.	94—96	+1	4 3 4
250,000	10	April 17	8	San Paulo, Ltd.	12—13*	..	6 3 1
135,000	Stk.	Mar. 12	10	Sheffield A	239—241	+5	4 3 0
209,984	,,	,,	10	Do. B	237—240	+3⅛	4 3 4
523,498	,,	,,	10	Do. C	237—239	+3	4 3 8
103,235	Stk.	Mar. 31	5	Shrewsbury Ord. 5 p.c.	111—114	..	4 7 9
6,000,000	Stk.	Feb. 12	5⅛	South Met., 4 p.c. Ord.	117—120	..	4 8 10
1,780,000	,,	Jan. 15	3	Do. 3 p.c. Deb.	90—92	−1	3 5 3
380,940	Stk.	Nov. 13	5	Southampton Ord.	105—110	−2	4 10 11
87,950	,,	Jan. 15	4	Do. 4 p.c. Deb.	100—103	..	3 17 8
120,000	Stk.	Feb. 26	6	Tottenham and Edmonton	A. 5 p.c.	117—122	..	4 18 4
300,520	,,	,,	4½		B. 3½ p.c.	93—96	..	4 13 9
182,380	10	Dec. 30	8	Tuscan, Ltd.	8⅛—9⅛	..	8 8 6
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.	94—96	..	5 4 2
730,872	Stk.	Mar. 12	5	West Ham, 5 p.c. Ord.	95—100	..	5 0 0
				WATER COMPANIES.			
780,662	Stk.	Dec. 30	11⅓	Chelsea, Ord.	315—325	+5	3 10 9
150,000	,,	,,	5	Do. 5 p.c. Pref.	145—150	..	3 6 8
160,000	,,	,,	4½	Do. 4½ p.c. Pref. '75	130—140	..	3 4 4
175,785	,,	Mar. 31	4½	Do. 4½ p.c. Deb.	137—142	..	3 3 5
1,720,560	Stk.	Mar. 31	8	East London, Ord.	235—240	+8	3 6 8
654,740	,,	Dec. 11	4½	Do. 4½ p.c. Deb.	142—147	..	3 1 3
1,282,943	,,	,,	3	Do. 3 p.c. Deb.	96—98	..	3 1 3
700,000	50	Dec. 11	8	Grand Junction	10 p.c. max.	123—128	+3	3 2 6
310,000	Stk.	Mar. 31	4		4 p.c. Deb.	123—128	..	3 2 6
708,000	Stk.	Feb. 26	10½	Kent	295—305	+5	3 8 10
160,000	,,	,,	7	Do. New, 7 p.c. max.	195—205	..	3 8 4
1,043,800	100	Dec. 30	11	Lambeth, 10 p.c. max.	300—310	..	3 11 0
406,200	100	,,	8⅓	Do. 7⅓ p.c. max.	220—230	+5	3 13 11
350,000	Stk.	Mar. 31	4	Do. 4 p.c. Deb.	122—127	..	3 3 0
500,000	100	Feb. 12	12⅛	New River, New Shares	390—400	..	3 4 0
1,000,000	Stk.	Jan. 29	4	Do. 4 p.c. Deb.	123—128	..	3 2 6
902,300	Stk.	Dec. 11	7	South-wark and	Ord.	228—233	+2	3 0 1
126 500	100	,,	7		7⅓ p.c. max.	200—210	+13	3 6 8
489,200	Stk.	,,	5		5 p.c. Pref.	150—153	.. 0	3 5 4
1,019,585	,,	Mar. 31	4	Vauxhall	4 p.c. A Deb.	122—127	..	3 3 0
1,155,066	Stk.	Dec. 11	10	West Middlesex		295—305	+5	3 5 7
200,000	,,	,,	4½	Do. 4½ p.c. Deb.		138—143	..	3 2 11
200,000	,,	Mar. 12	3	Do. 3 p.c. Deb.		95—97	..	3 1 10

* Ex. div.

loss account. They kept up the quality of the gas to the high standard of 22-candle power, with the result that the Municipal inspectors (who did their duty very thoroughly) had found no cause of complaint during the whole of the year. As an item of interest, he might mention that they had at present 27,963 meters in use, and that they had in addition 6850 public lamps. Of these, 1677 meters and 77 public lamps were fixed in the period under review. Turning to the report and accounts, they had spent £16,410 during the year out of revenue on upkeep of the works and mains, &c., as against £21,997 in the previous twelve months. There was thus a very considerable reduction in this item; but he could assure them that all the property was thoroughly well maintained. If they had not spent so much in 1902 as in 1901, it was because there was nothing else which required to be done. He only dwelt on this point because he wanted the shareholders to understand that the policy of the Board was to maintain the works and mains in the best possible condition. The wisdom of this policy was proved by the fact that he was again able to tell them that the leakage showed a still further reduction; it having been 1·10 per cent. less in 1902 than in 1901, while in the last-named year it was 1·5 per cent. less than in 1900. The revenue account showed a profit of £99,617, against £87,932—which was a very handsome increase. On the other side of the profit and loss account, the debenture interest stood at £12,427, against £12,185. It would be seen from the report that during the year the Company sold £5150 of debenture stock. The London office expenses amounted to £13,635, as compared with £12,452; the difference being caused entirely by the increase in the income-tax. Possibly they might in the current twelve months get some relief in this direction; but doubtless the shareholders would take into consideration that the dividend was paid free of this tax, and that, such being the case, the return was a good deal better than the nominal 7 per cent. Referring to the balance sheet, the capital was the same as before. The amount of debenture stock had, as he had already mentioned, been increased by £5150 only, notwithstanding the fact that £19,423 had been spent on capital account during the year. As far as could be seen, the Company had ample means to meet all their immediate requirements. Sundry creditors and credit balances were very much the same. On the other side of the account, the capital expenditure was shown; and it had been his usual custom to give the shareholders some idea of how the money had been spent. On this occasion, £9000 went to pay for the 16 miles of new mains; £2500 was for a coal-shed at the Corrales works (which was badly needed), and other small additions; and the balance of £8000 was spent on the new house and public lamp services, of which he had already spoken. The Buenos Ayres premises remained at the same figure as last year; and, needless to say, they had been well maintained, and were a valuable asset. This freehold land had advanced in price a good deal since they bought it. Coals, gas, residuals, stores, &c., in stock stood at £64,459, against £71,709; but this, of course, was a fluctuating item, and was never the same two days together. Next he came to the very important heading of sundry debtors and debit balances £66,099, as compared with £58,466 last year. They would probably remember that at the last meeting he had told them that the Municipality had fallen a little into arrear with their payments. This state of things continued to a certain extent up to the time when the present accounts were got out; but he was glad to be able to inform them that everything had since been paid up, and at the present moment the Municipality only owed for the current month. This item was therefore in all probability reduced now to £30,000. The Company's relations with the Municipal authorities—and especially with the Lord Mayor—were of a most cordial character. The Lord Mayor had succeeded in complying with the law, which stipulates for the lighting tax voted every year to be kept separate and paid to the Lighting Companies for this service. The amount of this tax more than covered the cost of the service; and if the law was carried out, the authorities ought never to be in arrear with their payments for public lighting. He now came to the proposed appropriation of the balance to the credit of the profit and loss account; and in this connection he had to refer to the item in the balance-sheet of "Discount on issue of debenture stock, as per last account, £16,384." This, to the minds of the Directors, was the only blot existing in the accounts. It was not an asset; and, of course, the money was gone. They had been amortizing it at the rate of £2000 per annum. Well, instead of adding further to the reserve fund, which now stood at £70,000, the Board thought it would be better to clear up the balance-sheet by getting rid of this discount item; and, by doing so, they would have £2000 a year more to dispose of. In his opinion, the Argentine Republic and Buenos Ayres had a very prosperous time before them. Since 1900, the country had been under a cloud; but it looked as though the long-drawn-out crisis was at an end. He was confident that no part of the world had a better future before it. The Chairman ended by moving the adoption of the report and accounts.

Mr. C. P. OGILVIE seconded the motion.

The CHAIRMAN, in reply to a question, stated that the reserve fund of the Company was invested in mains.

A dividend of 8s. per share, making, with the 6s. per share paid in October last, 7 per cent. for the year, free of income-tax, was afterwards declared; and the retiring Directors (Messrs. A. E. Bowen and C. P. Ogilvie) and the Auditors (Messrs. Welton, Jones, and Co.) were re-elected.

A vote of thanks was accorded to the Secretary, London Board, London staff, and the Local Committee, the General Manager (Mr. Gabarret), the Engineer (Mr. James Rowbotham), and the staff at Buenos Ayres.

The SECRETARY, in returning thanks, mentioned that he had only just returned from a visit to Argentina, and stated the impressions he had formed while there. He found the works of the Company in a high state of efficiency; and he congratulated the shareholders in possessing an interest in so satisfactory an undertaking.

A similar compliment to the Chairman and Directors concluded the proceedings.

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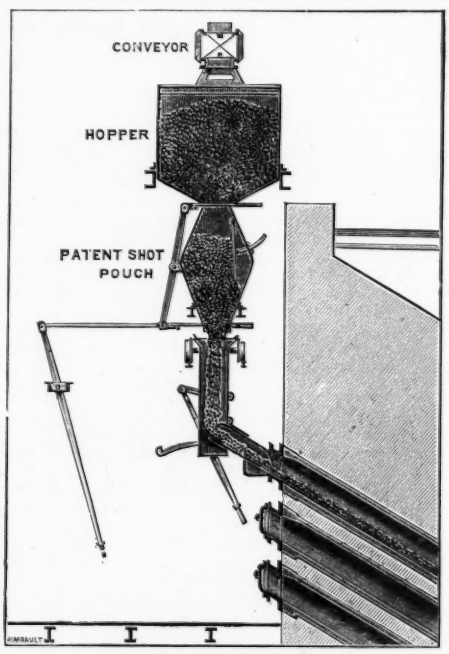

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THE WELSBACH COMPANY.

The Directors' Report and the Reorganization Scheme.

The report of the Directors of the Welsbach Incandescent Gaslight Company, covering the twelve months to March 31, which will be submitted at the annual meeting to be held on the 4th prox., states that, in view of the importance of making immediate progress with the reorganization of the capital, the Board have not felt justified in delaying the issue of the accounts until the receipt of the report of the Austrian Company. The present report therefore merely shows the earnings of the English business; and any dividend which may later on be declared by the Austrian Company will be added to the profits of the current year. The accounts show a profit for the twelve months of £51,908. From this sum has been deducted £6050 in respect of debenture interest, leaving a balance of £45,858. The Board are advised that, having regard to the enormous depreciation in the assets of the Company and the large losses of capital not yet provided for, no part of this sum can lawfully be distributed as dividend; and they have no alternative but to act upon this advice. The whole cash resources of the Company at March 31 are included in the assets necessary to justify the capital recommended by the Board and the Advisory Committee; and, if it were possible out of those cash balances to make any dividend distribution, there would have to be a proportionate reduction in the new capital of the Company. The net profit of £45,858 on the English business, after deducting debenture interest, compares with a net loss of £29,678 last year, and a net loss of £3196 in the preceding year. Referring to the reductions in price of the Company's productions, the Directors remark that these meant concessions to the public exceeding £30,000, and, in the first instance, a corresponding reduction in the gross trading profit. That it has been possible to make up this heavy initial loss and show a considerable profit is due, in a measure, to the steady growth of the Company's mantle trade, but mainly to the more efficient and economical methods of production which are now in operation, and to the sweeping reductions in the cost of administration and distribution which have been introduced. Under the latter heads alone an annual saving of over £50,000 has been secured; and the Board think it is just to their officials to state that they are more efficiently dealing with the business than the extravagant and overgrown staff which they superseded. Great care has been taken to maintain the pre-eminence of the Company's manufactures—an evidence of the success of which is that upon an increased output the return of defective mantles has during the year decreased by more than 20 per cent. as compared with the previous year. The arrangements mentioned in the last report with regard to the Kern Burner Company, and the division of the foreign and colonial patents between the original vendors and the Welsbach Company have been carried out. The Colonial patents are now vested in the Welsbach Company; and with the liquidation of the Kern Burner Company, a serious and steady drain on the resources of the Welsbach Company is stopped, while the trade arrangements made with regard to the Clamond stove and the Colonial patents have commenced to yield a profit. The Board next report that they have acquired, upon reasonable terms, an exclusive licence for a new process of mantle manufacture, which they believe will enable them very shortly to place on the market a mantle superior in point of illumination and durability to anything hitherto produced. A resolution will be submitted to the meeting authorizing the Directors to carry through, by agreement with Baron Auer von Welsbach, a separation of the "A" and "B" undertakings of the Austrian Company. The report concludes with the intimation that, since the date of the last report, Mr. Buchanan has been appointed Managing-Director with a seat at the Board, and Mr. Fletcher has been made General Manager. Mr. Buchanan and Major George Pringle have been appointed the representatives of the Company upon the Board of the Austrian Company, in place of Mr. Julius Moeller and Dr. Owen, who have resigned. The profit and loss account shows receipts amounting to £108,269, and an expenditure of £56,361—leaving a gross profit of £51,908, and a net profit (after deduction of £6050 for debenture interest) of £45,858.

The Reorganization Scheme.

The following are the details of the proposed reorganization scheme. The existing capital is set forth as follows:—

5½ per cent. debentures	£110,000
5 per cent. cumulative preference stock	1,500,000
Ordinary stock ranking for cumulative 7 per cent. dividend	1,350,000
Deferred £1 shares ranking for cumulative 7 per cent. dividend	629,539
Total	£3,589,539

On these stocks, the present cumulative annual charges are: Debentures, £6050; preference stock, £75,000; ordinary stock, £94,500; and deferred shares, £44,067—a total of £219,617.

The interest on the debentures has been regularly met. The dividends on the preference stock are in arrear from March, 1900; these arrears totalling £225,000. The ordinary shares received 7 per cent. to March 31, 1899, and an interim dividend of 2½ per cent. on account of the following year. Nothing has since been paid; and the arrears (as against the deferred shares) total £344,250. The deferred shares received 7 per cent. to March 31, 1898, and nothing since.

According to the scheme, the new share capital shall consist of—

600,000 6 per cent. cumulative preference shares of £1 each	£600,000
745,000 ordinary shares of £1 each	745,000
	£1,345,000

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The whole of the 600,000 new preference shares, together with 375,000 ordinary shares, are to be allotted to the holders of the existing preference stock. So that each stockholder will receive 40 per cent. of his present holding in new preference shares, and 25 per cent. in ordinary shares—a total of 65 per cent.; while the proportion of new capital absorbed is 72·49 per cent. To the ordinary shareholders, 337,500 new ordinary shares will be allotted; being 25 per cent. of their present holdings, and 25·09 per cent. of the total new capital. The deferred shareholders are to receive one new ordinary share for every 20 deferred shares; being 5 per cent. on the present holdings, and 2·42 per cent. of the new capital. For this purpose, 32,500 shares are allocated; but 1024 of these will remain unissued. It the event of the Company being liquidated, it is proposed that the new preference shares shall, so far as the assets will allow, be repayable at the rate of £1 10s. for each £1 share. The preference and ordinary shares will entitle the holder thereof to one vote in respect of each share.

It is proposed to pay off the existing 5½ per cent. debenture stock in the course of the next few years. With this object in view, the Board will from time to time, as the Company's funds may justify, invite offers of this stock by tender.

Dealing with the apportionment of profits and control, the circular proceeds:

Under the foregoing scheme of reorganization, the Company will be in a position to pay the 6 per cent. dividend on the preference shares, and to make a distribution of 5 per cent. on the ordinary shares, when the profits available for dividend amount to £73,250. It will be seen that the present preference stockholders will have nearly three-fourths of the whole capital of the Company, with a corresponding majority of the voting power. They will also be entitled to a fixed cumulative preferential income of £36,000 per annum, and, in addition, to over one-half of the remaining divisible profits; so that when a distribution of 5 per cent. is made on the new ordinary shares, the dividends receivable by the present preference stockholders will amount to £54,750. After providing the proposed preferential charge of £36,000 per annum, the present ordinary stockholders will be entitled to nearly one-half of the remaining divisible profits and one-fourth of the voting power. The present deferred shareholders will receive dividends upon the proportion of ordinary shares now allocated to them. Separate certificates will be issued for fractions of £1; but such fractions will not rank for dividend.

The Position of Shareholders.

The foregoing scheme has been arrived at after long and careful consideration of the special rights of the several classes of proprietors; and the following considerations are suggested as bearing on its effect upon the position of each class.

As to the preference stockholders. (1) In place of an investment which is not represented by assets, on which no dividends have been paid since March, 1900, and upon which the Board are advised no dividends can lawfully be paid until the loss of capital has been either made up or written off, there will be secured to them (*a*) £600,000 of their present nominal capital in 6 per cent. cumulative preference shares, which should be dividend-paying from the commencement; and (*b*) £375,000 of their present nominal capital in a security which should also be dividend-paying. These together make £975,000; being equivalent to 65 per cent. of their present nominal capital of £1,500,000, and nearly three-quarters of the new issued capital, carrying therewith a predominant voting power. (2) By reason of the proportion of capital allocated to them, they will be entitled to a fixed cumulative dividend of £36,000 per annum and to over one-half of the remaining divisible profits. (3) They are thus given a substantial interest in the future prosperity of the Company; and in the event of the growth of profits ultimately permitting a total distribution in any year of £114,000 in dividends, the return to the preference shareholders will be equal to the full dividend of 5 per cent. on their present nominal capital of £1,500,000—namely, £75,000. Any distribution in excess would represent a clear gain to them of income. (4) Upon the repayment of the existing £110,000 of 5½ per cent. debenture stock, the preference shareholders will have a first charge upon the profits; while the possibility of an unforeseen increase in the value of the assets is met by the provision that, in the event of liquidation, the new preference shares shall be repayable at a premium of 50 per cent.

As to the ordinary stockholders. (1) In place of an investment which is yielding no return, and which in existing circumstances cannot yield any return for many years to come, they will receive £337,500, being equivalent to 25 per cent. of their present nominal capital, in shares which should be earning dividends as soon as the reorganization is carried through. (2) Instead of having a cumulative income charge of £75,000 a year ranking ahead of them (of which £225,000 was in arrear at March 31, 1903), the cumulative charge will be reduced to £36,000 (apart from the sum temporarily payable by way of interest on the debenture stock). (3) While independently of the cumulative character of the income charge at present ahead of them they could not begin to receive any dividend until after £75,000 had been distributed to the preference stockholders, they will now be entitled to dividends on their new security when the divisible profit exceeds £36,000; and it will be observed that a smaller divisible profit than the amount of the present prior charge will permit of the payment of a dividend of 5 per cent. on their new security.

As to the deferred shareholders, they are offered a small, but certain, holding in an ordinary share, unencumbered by accumulated arrears of prior charges, which will yield a return whenever the divisible profits exceed £36,000 a year, and will be entitled to a dividend of 5 per cent. when these profits equal £73,250, in place of an investment which is entirely unrepresented by assets of any nature whatsoever, and is not entitled to any revenue until arrears of dividend on the preference and ordinary capital, amounting together at March 31, 1903, to £569,250, are satisfied, and then only if the divisible profits from year to year are in excess of £169,500. So that, for all practical

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purposes, the present deferred share is destitute of any valuable rights, dresent or prospective, either in capital or revenue.

Although it cannot be expected that, where so many conflicting interests prevail, the foregoing or any scheme will prove to be in accord with the views of every proprietor, it is believed by the Board and the Advisory Committee, who have carefully considered a large number of alternative proposals, representing all shades of opinions and interests, that the above proposals constitute an arrangement which may properly be accepted by each class as representing a fair and equitable solution of a difficult position. The Board and the Advisory Committee believe that the interests of the business, and of all the proprietors thereof, will be benefited by the adoption of the present scheme of arrangement, and it has their unanimous recommendation.

The Assets of the Company.

Accompanying the reorganization proposals is a further circular from the Secretary, dealing with the value of the assets of the Company. The circular proceeds:

I am directed to send you herewith proposals for the reorganization of the capital of this Company settled by the Board in consultation with the Advisory Committee. Upon the conclusion of the ordinary business at the general meeting on May 4, a resolution will be submitted affirming the principle of these proposals. Should the sense of the proprietors be favourable to the scheme submitted, separate meetings of the three classes of proprietors will, without delay, be summoned to obtain their sanction to the necessary modifications of the Memorandum and Articles of Association of the Company; and afterwards such further meetings of the Company will be called and other steps taken as may be requisite to give legal effect to the agreement.

In settling these proposals, the Board have proceeded upon the lines of the recommendations contained in the Advisory Committee's report dated the 19th of December, 1901. It is desirable to recall that the Advisory Committee found that the Company had been "enormously over-capitalized, and that the properties transferred by the vendors were transferred at a grossly exaggerated value," and that it was "essential that the capital should be largely reduced." They further pointed out the necessity of any plan of reorganization, including provision for additional working capital. The Board, accepting office to give effect to this policy, undertook, at the annual meeting in July last, to prepare and present a scheme of reorganization as soon as an estimate could be made of the probable earnings of the Company under the new conditions. Since then the Advisory Committee have conferred with the Board on the subject, and together they have carefully considered many methods of dealing with it including proposals that have been laid before them by individual proprietors.

The Board have made a careful valuation of the assets of the Company, including therein all cash in hand, on deposit, and in Consols on the 31st of March, 1903, amounting to £167,414; and taking the shares in the Austrian Company at their full value, they are unable to place a greater present value upon these assets than £450,000 (after deducting, as they must do, the £110,000 of 5½ per cent. debenture stock). It will be seen, therefore, that to make up the new capital now proposed of £1,345,000, it is necessary to add no less than £900,000 for goodwill. More than this ought not to be added; and the Board consider it would not have been possible to recommend so large a sum in respect of goodwill but for the improvement in the English business which the accounts for the past year show. But even after making this liberal addition to the proposed new capital in respect of goodwill, there remains an amount of about £2,000,000 of the existing capital which is not represented by any assets, and which, if the Company is to be placed on a sound basis, and the payment of dividends resumed at an early date, it is essential to cancel forthwith.

As the proprietors know, this Company in 1897 and 1898 purchased 1431 shares of 1000 gulden (say, £83) each, out of a total of 1500 shares in the Austrian Company, at a cost of £1,452,940, or over £1000 per share. The dividends paid by the Austrian Company have fallen year by year, with the result that the value of the shares has greatly depreciated. During the past few months, the Board have purchased from various persons at different times fourteen further shares at an average cost of about £155 each; and they have heard of other sales at about that price. This fall in value represents a depreciation of no less than £1,200,000 in this Company's investment in Austria. The Board regret to state that, in their opinion, there is ample justification for this reduction in value, and that there is no present reason to suppose that any material part of it can be recovered. Indeed, as regards dividend results, the Board's information is that the Austrian dividend for the year ending the 31st of March last is again likely to be less than the dividend for the previous year; and as regards the year beginning the 1st inst., it is probable there will be a still further reduction. The Austrian mantle patent expired on the 28th of March last, and the Austrian Board have felt compelled to put in operation a material reduction in the price of their mantles, which they state must prejudicially affect the profits of the current year.

Unfortunately, there is, at present, no reason to suppose that this shrinkage will be compensated by any profits from the osmium lamp, the property of the "B" (electric) undertaking. It is to be regretted that in former years proprietors have been led to expect so much from this invention. It should be again explained that the interest which this Company has in the osmium lamp is that, as the principal shareholder in the "A" (gas) undertaking, it is entitled to practically three-sevenths of any profits which the "B" undertaking may distribute as dividends. The constitution of the "B" undertaking, however, is such that the Directors of the Austrian Company may accumulate very large reserves in the "B" undertaking, amounting in all to about £500,000, before the "A" shareholders are entitled to participate in its profits. So far the "B" undertaking has not made any profits available for dividend; and the osmium lamp is still in process of development. It is right that the proprietors should also know that,

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PREPAYMENT METER.

to continue these developments, the "B" undertaking has resumed borrowing from the "A" undertaking. As the Board state in their report, they consider that the connection of the "A" and "B" undertakings under the conditions which prevail works to the prejudice of this Company, and they desire to bring about a separation of the two undertakings. If this is accomplished, it will at least have the effect of giving the Company that control over its property in Austria of which it was deprived by the disastrous agreement of March, 1898.

The Board consider that the existing debenture debt of the Company, amounting to £110,000, and carrying interest at the onerous rate of 5½ per cent., should be retired as soon as possible. The debenture stockholders are creditors of the Company with, in its present strong financial position, ample security for their debt; and that being so, the only practicable way to retire their charge is by payment. With this view, the Board propose from time to time as may be convenient to the Company to invite tenders of stock.

METROPOLITAN WATER BOARD.

The Question of Salaries—Chairman and Vice-Chairman to be Unpaid.

The Second Meeting of the Board was held at the Caxton Hall, Westminster, last Thursday—Sir J. T. RITCHIE presiding.

The Committee appointed at the first meeting (*ante*, p. 44) reported that they had met three times, and that on the first occasion they appointed Mr. R. M. Beachcroft (London County Council) to act as Chairman. They commenced by considering the question of a Board Room. The Metropolitan Asylums Board had generously offered their room for the present; but the offer was declined with thanks, and a recommendation was submitted to the effect that application should be made to the Westminster City Council for the use, during the next twelve months, of the Council Chamber and certain rooms at Caxton Hall. It was decided to use the rooms in the hall until more suitable ones could be provided. With respect to the day and hour of the meeting, the Committee recommended—"That a circular letter be addressed by the Acting Clerk to the members, inviting them to state the day of the week and the hour most convenient, in their opinion, for the meeting of the Board;" and this was adopted. The report next dealt with the question of appointing a Clerk, Solicitor, Engineer, and Financial Adviser. The Committee were of opinion that the appointment of officials should be, as far as possible, of a temporary character, for on the "appointed day" the services of the Clerks, Secretaries, Engineers, and other officers of the Companies, would be transferred to the Board. They considered that one permanent appointment, that of the Clerk, should be made at once, and they recommended—"That the Clerk to be appointed should be the chief official of the Board; that he be engaged during the pleasure of the Board; that the salary to be attached to the office be at the rate o £1500 per annum; and that an advertisement inviting applications for the office be issued forthwith."

Lieut.-Col. COLVILE took exception to both the salary and the wording of the resolution. He considered that the words "chief official," together with the high salary, would lift the official high above them. He proposed, as an amendment, that "a Clerk be appointed to perform the duties of Secretary," and that the salary should be at the rate of £1000 per annum.

Lieut.-Col. PROBYN said he did not mind so much about the salary, though he would prefer that it should be £1200 or £1500, but he wanted a very good man. He objected in Committee to the words "chief official."

After considerable discussion, Lieut.-Col. Colvile withdrew his amendment, and the report was adopted, with the omission of the words "chief official."

With regard to the appointment of Chairman and Vice-Chairman, the Committee reported that the successful conduct of the arbitrations would largely depend upon the supervision exercised by the Chairman; that he must either be or become familiar with the intricacies of water legislation; and that he and the Vice-Chairman would have to make themselves acquainted with every branch of the Board's work as it developed, and hold all the threads in their hands. They would have to devote a very considerable portion of their time to the duties connected with the business of the Board.

Mr. I. H. BENN moved—"That the Chairman and Vice-Chairman shall devote the whole of their time to the business of the Board."

The further consideration of this portion of the report was deferred until the remuneration of the Chairman and Vice-Chairman had been discussed.

The Committee recommended that the only Standing Committees that need at present be appointed were: (1) A Law and Parliamentary Committee; (2) a Finance Committee; and (3) a General Purposes Committee.

Mr. BEACHCROFT said the Committee considered that these Committees would be sufficient until the "appointed day;" and they suggested that each should consist of not more than 22 members, who could appoint Sub-Committees.

The recommendation was agreed to.

The funds required to meet the immediate expenses of the Board were next considered by the Committee, who recommended that application should be made to some bank for, in the first instance, £5000. This question, which was the last in the report, was referred to the Finance Committee.

The Board next considered whether any, and, if so, what salaries would be assigned to the offices of Chairman and Vice-Chairman.

After much discussion, the Board divided on the question, when it was decided, by 34 votes to 23, not to pay the Chairman and the Vice-Chairman; and the appointment of these gentlemen was left till the next meeting, which was fixed for next Thursday.

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NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Following up the report upon public lighting which I mentioned a fortnight ago as having been presented to the Corporation of Edinburgh by the Inspector of Lighting, the Committee of the Town Council who have charge of the lighting of the city have resolved to recommend that ten streets be lighted by incandescent gas, and that three or four other thoroughfares have electric arc lamps erected in them. There is still, as will be seen, a reluctance to do much for the gas lighting. It is admitted to be about the poorest in existence; yet I find that this week the same Committee have resolved to recommend an estimate for next year of £42,415 for public lighting, which compares with an expenditure in the current year of £40,790, and last year of £39,531. The Committee do not, however, go far enough back in their comparison. Fifteen years ago, the annual cost of lighting the streets of Edinburgh was about £14,000. It is now, roughly speaking, three times as much. I know that since then the lighting of common stairs has been put upon the rates; but even taking account of this circumstance, the cost of public lighting has risen alarmingly. How is this state of matters consistent with the continued poverty of the lighting? Only in one way—that the lighting authorities have attended to electricity, which is the most costly branch, and which is confined to a few thoroughfares, and have neglected gas, which is still the more general system of lighting, and which, on account of its universality, ought to have had their first attention. In short, electric lighting has been pushed at the expense of gas lighting.

The accounts of the Dundee Corporation Gas Department close on the 30th inst.; but so keen is newspaper rivalry in the town, that it has been thought advisable by the management of the "Dundee Advertiser" to anticipate the event by a preliminary announcement, which appeared yesterday, and was in the following terms: "With the approach of the end of the financial year of the Gas Department, attention is being directed to the possibility of a substantial reduction in the price of the illuminant. It will be some weeks yet ere the balance has been struck; but there is a firm belief that the difficulties which have beset the department in recent years are now at an end. During the greater part of the year just closing, the full benefit has been gained of the labour-saving machinery that was introduced, and of the extensive reconstruction that was carried out. There was also the change in management, from which much was and is expected. It was recognized when the current year's estimates were made up that it was pretty much a case of guessing; but subsequent official statements showed that the cost of carbonizing coal had been considerably reduced, and that a nearer approach had been made by the gas produced from the retorts to the quantity ascertained by analysis. As to the extent of the reduction, opinions vary. It has been placed as high as 4d. per 1000 cubic feet, although other estimates have been more modest. A feeling is gaining ground that it would be good business to make a substantial reduction in order to develop the use of gas for other than lighting purposes, and trust to the increased consumption to make up for any loss sustained by the lessened price."

On Thursday, the Corporation of Dunfermline inspected the extensions and alterations which have been made at the gas-works, upon the advice of Mr. Alex. Waddell, their Engineer and Manager. New plant has been introduced for the handling of coal and coke, by which hand labour is all but superseded. Coal and coke are kept apart, and can be mixed in the proportions required; and the coke can be sized before sale. The latest estimate of the saving effected by the new plant shows that the cost of coal trimming—previously £142 per annum—will be entirely done away with; while £200 will be saved in labour (riddling and loading coke), and £600 in labour in the retort-house. It is also expected that £200 will be realized from the additional saleable quantity of coke. The total estimated saving is thus £1142; and it is explained that while formerly when an order (say) for, 200 tons of coke was received, 14 men had to be put on the job to load up now, with the machinery, only two men are required. The same remark applies to the coal. The improvements have been carried out at a cost of about £6000, which, it is expected, will be repaid in a very short time.

There used to be a good deal to say about the gas undertaking in the Greenock Town Council; but a new spirit seems to pervade the members, for the gas minutes are, as a rule, adopted without comment, except, it may be, a short explanation by the Convener of the Gas Committee. At this week's meeting, the report of the Committee was adopted without so much as explanation being vouchsafed. During March, the quantity of gas manufactured was 26,602,400 cubic feet—a decrease, when compared with March of last year, of 2,123,400 cubic feet. The average make per ton of coal was 10,367 cubic feet. I suppose the happy state of matters which now prevails must be attributed to the circumstance that the Manager (Mr. W. Ewing) has succeeded in convincing the councillors that his proposals are in the right direction. It is manifest to anyone that everything Mr. Ewing puts his hand to prospers. The yield of gas per ton of coal shows what he can do in the retort-house. That the consumption is declining, is not due to anything which has been done, or is being done, by the Manager, but to the Corporation restricting the output, by retaining inadequate mains, and, for the same reason, not pushing the sale of gas for cooking and heating. There is a good field in Greenock for a stove trade; but first of all there must be a new main into the town, to provide the gas for it.

The Galston Gas Company is a small undertaking, the annual make of gas being only about 9 million cubic feet; but there are few concerns of the kind which are better managed. That good management was a necessity, will be understood when it is known that they have been supplying up to 60,000 cubic feet of gas per day, and had only a storage capacity of 25,000 cubic feet. This difficulty is now removed, because on Thursday of last week a new holder of 80,000 cubic feet capacity was formally inaugurated. The holder has been

CARBURETTED WATER-GAS APPARATUS

Merrifield—Westcott—Pearson Patents.

The Economical Gas Apparatus Construction Co., Ld.

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W. H. PEARSON, Junr., Deputy-Chairman.
J. T. WESTCOTT, M.E., Manager.
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CARBURETTED WATER-GAS ENGINEERS.

The above Company have erected since 1893, or are now erecting, their Universal Type of Carburetted Water-Gas Plant at the following Gas-Works:—

	Cub. Ft. Daily.		Cub. Ft. Daily.		Cub. Ft. Daily.
BLACKBURN	1,250,000	ST. CATHERINES (Remodelled)	250,000	ACCRINGTON	500,000
WINDSOR ST. WORKS, BIRMINGHAM	2,000,000	KINGSTON, PA.	125,000	TONBRIDGE	300,000
SALTLEY WORKS, BIRMINGHAM	2,000,000	PETERBOROUGH, ONT.	250,000	STRETFORD	500,000
COLCHESTER	300,000	WILKESBARRE, PA.	750,000	OLDBURY	300,000
BIRKENHEAD	2,250,000	ST. CATHERINES (Second Contract)	250,000	TODMORDEN	500,000
SWINDON (New Swindon Gas Co.)	120,000	BUFFALO, N.Y.	2,000,000	SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000	WINNIPEG, MAN.	500,000	YORK (Second Contract)	750,000
WINDSOR ST., BIRMINGHAM (Second Contract)	2,000,000	COLCHESTER (Second Contract)	300,000	ROCHESTER (Second Contract)	500,000
HALIFAX	1,000,000	YORK	750,000	NEWPORT (MON.)	250,000
TORONTO	250,000	ROCHESTER	500,000	TOKIO, JAPAN	1,000,000
OTTAWA	250,000	KINGSTON, ONT.	300,000	PERNAMBUCO (Brazil)	125,000
LINDSAY (Remodelled)	125,000	CRYSTAL PALACE DISTRICT	2,000,000	MALTON	150,000
MONTREAL	500,000	DULUTH, MINN.	300,000	DULUTH, MINN. (Second Contract)	300,000
TORONTO (Second Contract Remodelled)	2,000,000	CATERHAM	150,000	BROCKVILLE (ONT.)	250,000
BELLEVILLE	250,000	LEICESTER	2,000,000	SMETHWICK	500,000
OTTAWA (Second Contract)	250,000	ENSCHEDE (HOLLAND)	150,000	GRAVESEND	300,000
BRANTFORD (Remodelled)	200,000	BUENOS AYRES (RIVER PLATE CO.)	700,000	NEWPORT MON. (Second Contract)	250,000
		BURNLEY	1,500,000	TORONTO (Third Contract)	750,000
		KINGSTON-ON-THAMES	1,750,000		

Complete Gas-Works at NELSON, BRITISH COLUMBIA.

LEEDS, 1,800,000 C. Ft. LEICESTER (2nd Cont.), 1,000,000 C. Ft. NEWCASTLE-ON-TYNE, 1,800,000 C. Ft.
MONTREAL, ONT. (Second Contract) . . . . . 1,800,000 Cub. Ft.

erected by Messrs. Clayton, Son, and Co., Limited, with Mr. W. Fairweather, of Kilmarnock, as Engineer. The holder is constructed so that it may be telescoped should occasion arise. The gas from the new holder was turned on to the town by Mr. John Hendrie, the Chairman of the Company. Mr. R. Muir, the Manager, is to be congratulated upon this addition to his works, and upon the happy position he is now in.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *April* 25.

Sulphate of Ammonia.

Throughout the week the market has been quiet, and prices have eased off at all points; the closing quotations being £13 2s. 6d. per ton f.o.b. Hull, £13 5s. per ton f.o.b. Liverpool, and £13 7s. 6d. per ton f.o.b. Leith. There has been no fresh Continental demand, and although there has been a revival in home demand, it has scarcely been enough to absorb available supplies. Interest in the forward position has entirely disappeared, and quotations are therefore only nominal.

Nitrate of Soda.

This is firm at 9s. 6d. to 9s. 9d. per cwt., according to quality, though deliveries are scarcely so satisfactory as they were a short time back.

LONDON, *April* 25.

Tar Products.

The markets remain dull; and there does not appear to be much business doing. In pitch, there is nothing fresh to advise. The market is undoubtedly quiet. At the same time, there is a fairly good demand for prompt delivery; consumers being evidently anxious to fill up their requirements for the summer months before the hot weather sets in. As regards forward delivery, there is not much demand. Consumers will probably wait before contracting, in the expectation of lower prices. In benzol, there is really nothing to advise. The position remains unchanged. Small quantities of 90 per cent. have been sold at 9d. for prompt; but in 50-90 per cent. there does not appear to be anything doing. Solvent is very quiet; and the demand is limited to small quantities for home consumption. One or two small sales of toluol are reported at 7d. and 7¼d.; but, as a rule, this article is quite neglected. Crude carbolic acid is in better demand. Business is reported in 60's at 1s. 6½d. May-June; while 1s. 7d. is being freely offered for July-December. In creosote, the demand is easier in both London and the provinces. The inquiry for export is not so strong; and, so far as London is concerned, there is a slightly downward tendency. In anthracene, there is nothing fresh to advise. Consumers are still open to purchase over next year; and it is reported that some quantity of "A" quality has already been placed for July-December of the present year.

The average values during the week were: Tar, 22s. to 28s. Pitch, London, 57s. 6d. to 58s.; east coast, 54s. to 55s.; west coast, 53s. to 53s. 6d. Benzol, 90 per cent., 8½d. to 9d.; 50-90 per cent., 7d. to 7½d. Toluol, 7d. to 7¼d. Crude naphtha, 3d.; solvent naphtha, 8d. to 8¼d.; heavy naphtha, 9d. Creosote, London, 1½d. to 1⅝d.; North, 1¼d. to 1⅜d. Heavy oils, 2d. to 2½d. Carbolic acid, 60 per cent., 1s. 6½d. to 1s. 6⅝d. Naphthalene, 35s. to 50s.; salts, 22s. to 24s. 6d. Anthracene, "A" quality, 1⅜d. to 1⅝d.; "B" quality, 1d. nominal.

Sulphate of Ammonia.

There is really nothing doing; and it is difficult to fix the exact values, owing to the absence of inquiry. Prices are therefore mostly nominal. At the moment, the Gaslight and Coke Company are not quoting in any position; but there are sellers on Beckton terms at £13 7s. 6d., prompt shipment. In Hull, there is no business doing. Makers still quote £13 7s. 6d.; but £13 5s. is probably the actual market value. In Leith, makers are quoting £13 10s.; but consumers at present will not pay more than £13 7s. 6d., and even at this price there is no actual business doing. In Liverpool, there is no business of importance to report; but the nominal value may be taken as £13 5s.

COAL TRADE REPORTS.

Lancashire Coal Trade.

Though any definite announcement of a reduction in prices is not likely to be made until after the adjourned meeting of Lancashire coal-owners which is to be held in Manchester to-day (Tuesday), it is pretty well understood that this is to come about; and, in fact, representatives of the principal collieries admit that some more or less general easing down at any rate in house-fuel prices is only proper. The continuance of colder weather, following upon the restriction of output during the somewhat protracted Easter holidays, has, for the time being, steadied the market, and also kept pits on full time with the output as a rule moving away. This position is regarded as only temporary, and not sufficient to justify any further postponement of concessions in price which had previously become necessary owing to the downward movement in other districts and the competition of surplus supplies from Derbyshire, Staffordshire, and Yorkshire coming into outside markets. In view of the practically certain reduction in house-fuel prices, buying, though there has been more briskness of inquiry, has been chiefly limited to small quantities, and has given quite a temporary stimulus to what may be termed the "bagging" retail trade. At present quotations remain on the basis of about 14s. to 15s. per ton at the pit for the better qualities of Wigan Arley, 12s. to 13s. for seconds Arley and Pemberton four-feet, and 10s. to 11s. for common house-fire coals. Although as regards gas coals the settlement of contracts is still hanging fire in

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MAXIM PATENT CARBURETTOR

FOR ENRICHING GAS IN BULK.

PREVENTS NAPHTHALENE DEPOSITS.

OVER 100 MAXIM PATENT CARBURETTORS HAVE NOW BEEN FIXED.

Among the Companies and Towns supplied are The Gas Light and Coke Company, The South Metropolitan Gas Company, Birmingham, Leeds, Rochdale, Bristol, Sheffield, Southport, Alloa, Broughty Ferry, Dunfermline, and many other Works, both large and small, where they have been working in some instances for the past Seven Years.

MORE GAS & SALEABLE COKE PER TON of COAL CARBONIZED is PRODUCED; SAVING CAPITAL, LABOUR, FUEL, WEAR & TEAR, &c.

THE ENRICHMENT IS INSTANTANEOUS AND PERMANENT.

The Carburettor is inexpensive, easily fixed, and entirely supersedes the use of Cannel.

Dealers in Benzol, Carburine, and all other Naphthas and Oils suitable for the Enrichment or Production of Gas.

For Prices and full Particulars, apply to

THE GAS LIGHTING IMPROVEMENT COMPANY, LIMITED,

18, DEVONSHIRE STREET, BISHOPSGATE, LONDON, E.C.

anticipation of lower prices than last year, coalowners show little or no disposition to give way in any material measure—concessions of possibly 3d. per ton being talked of as about the full extent to which they are likely to go. At the pit, ordinary qualities of round coal are tolerably firm at from 8s. 6d. to 9s., with quotations in some special cases as much as 9s. 3d. per ton; and if these prices can be maintained, it is obvious there is not much inducement to very materially cut down quotations for gas coal contracts. There is still generally a scarcity of engine fuel, especially the better qualities; and the demand, taking it all through, continues in excess of requirements. At the pit, common slacks average 4s. 6d. to 4s. 9d. up to 5s. per ton, good medium sorts 5s. 9d. to 6s. 3d., and best qualities 6s. 9d. to 7s. and 7s. 3d. Shipping remains only indifferent; holders of stocks being ready to accept 9s. 6d. to 9s. 9d. for clearance sales of common round coal, with the better qualities quoted at 10s. to 10s. 3d. per ton delivered at the ports on the Mersey.

Northern Coal Trade.

The demand for coal has been, on the one hand, increased by the opening out of the trade to the Baltic, which takes steam coal freely from this district; but, on the other hand, there is the falling off in the consumption of coal both for gas and household purposes, so that the two Northern counties are rather unequally affected by the change in the trade. Best Northumbrian steam coals are in good demand, and the price is firmer, the quotation being now about 10s. 9d. per ton f.o.b.; while second-class steams are from 9s. to 9s. 6d., and steam smalls from 5s. 6d. to 5s. 9d. In the gas coal trade, there is now much negotiation as to contracts, both for home and foreign needs. One Norwegian contract is expected to be soon arranged at prices that are about 6d. to 8d. per ton below those of last year. There are also now some negotiations for the supplies of the London Gas Companies; and in these cases also there must be expected to be lower prices. But the actual figures are not likely to be known for some days at least. For occasional cargoes, the quotation for Durham gas coals is from 8s. 6d. to about 9s. per ton f.o.b. in the Tyne. Coke is firm for nearly all kinds; gas coke being in lessened make, and the quotation being from 12s. 3d. to 12s. 6d. per ton for good sorts, f.o.b. in the Tyne.

Scotch Coal Trade.

The exceptional dulness of the market at present is almost sufficient to justify apprehensions as to stirring times in the near future. Both buyers and sellers appear to be waiting for some change in the currency of events. Meantime, the demand is slack, and prices are by no means improving. The quotations are: Main 8s. to 8s. 3d. per ton f.o.b. Glasgow, ell 8s. 9d. to 10s., and splint 9s. 3d. to 9s. 6d. The shipments for the week amounted to 193,552 tons—a decrease of 23,556 tons upon the preceding week, but an increase of 13,013 tons upon the corresponding week of last year. For the year to date, the total shipments have been 2,862,968 tons—an increase of 123,979 tons upon the same period of last year.

Sale of Shares.—At the Mart, Tokenhouse Yard, E.C., last Tuesday, Mr. Alfred Richards sold by auction, by order of the Directors, £5000 of 4 per cent. perpetual debenture stock of the Tonbridge Gas Company, at prices ranging from £100 5s. to £101 per £100 of stock; also a new issue of £10 ordinary shares in the Aldershot Gas and Water Company, carrying 7 per cent. dividend, at £13 12s. 6d., £13 15s., and £13 17s. 6d. each. On the same occasion, he placed a new issue of £5000 of 5 per cent. ordinary stock of the South Essex Water Company, ranking for a maximum dividend of 5 per cent., and entitled, in view of the last dividends paid, to a proportionate one at the rate of 4 per cent. per annum, at prices ranging from £100 5s. to £101 per £100 of stock. A few £10 shares in the West Kent Gas Company fetched £18 15s., £18 17s. 6d., and £19 apiece.

Cologne Gas Lighting and Heating Exhibition.—This exhibition, which is an exceptionally interesting one, was officially opened on Saturday, the 18th inst., by Herr Reigierungs, the President of the Government of the Cologne district. The incandescent mantle and burner industry of Germany is well represented; and many novelties are shown. One of the most notable exhibits is that of the Blackman Export Company, Limited, of London, who show the "Keith" light on a fairly large scale. In a very small area, the Company show lamps having a total illuminating power of 4500 candles, and so brilliant is the effect produced in the exhibition that all the other gas-lights in the vicinity are practically blotted out. This is what the "Cologne Gazette" says of the Keith exhibit: "The light is of enormous power and beauty. It is, indeed, more agreeable for the eyes than the electric arc light, and does not change colours as the latter does. It has the additional advantage of being far cheaper, both in the cost of installation and for the light given. There are more than 800 installations in Germany and England of this wonderful light. The burners in the exhibition are all ignited by 'Keith' electric lighters. The whole display is most attractive." During the proceedings at the opening, Herr Henking, the President of the Exhibition, concluded an address to the exhibitors and those present, by saying that, in his experience, this was the first time that exhibitors from England, like the Blackman Export Company, and their Mr. James Keith, Assoc.M.Inst.C.E., had united with Germans in a gas exhibition of this kind. He wished the co-operation every success.

Messrs. R. Dempster and Sons, Limited, of Elland, have received repeat orders for regenerator settings from the Coalville Urban District Council.

The Directors of the Newcastle-upon Tyne and Gateshead Gas Company offered for sale by tender last week £50,000 of 4 per cent. preference stock. The minimum price was £102 10s. per cent. The whole of the amount offered was applied for, and allotted at an average price of £102 15s. 3d. per cent.

A HEALTHY PROSPECT.

To ensure your trade this Summer exceeding last year's, you should put on your hire list the most popular Gas Cooker in the market:—

WRIGHT'S

New Century

"Eureka"

Cooker.

It is reported that one of the most valuable anthracite coal deposits in the United States has been discovered in Western Pennsylvania. It is estimated to hold the enormous total of 300 million tons of coal, and it will not be exhausted for two centuries. The deposits are assumed to be worth £200,000,000.

At the recent annual apparatus exhibition of the French Physical Society in Paris, the entrance hall and vestibule were lighted with "Heliophone" lamps of the French Incandescent Gas Company, the staircase and ground floor by the French Oxyhydrogen Company, and the entrance hall of the first floor by Nernst lamps.

Mr. Fred. C. Robus, second son of Mr. H. J. Robus, who became a Freeman of the City of London in November last, has just been elected a Liveryman of the Merchant Taylors' Company, after passing through the seven years' servitude. Mr. Robus's eldest son and himself have been for many years on the Livery of the Blacksmiths' Company.

We have received from Messrs. Fletcher, Russell, and Co., Limited, the first section of their lists of cooking and heating apparatus. It is No. 235, and comprises the latest types of gas heating and domestic labour saving appliances produced up to last month. They occupy about 130 quarto pages, and are very effectively presented. The list is a highly artistic production in chocolate and black; and it is accompanied by a well-executed coloured plate, showing the firm's gas cooking-range No. 170, fitted with patent removable enamelled linings and tray, and copper side boiler and hood.

Under the auspices of the Gas and Electricity Committee of the Longton Town Council, an interesting exhibition has just been held in the Town Hall, in order to show what the Committee are able to supply in the way of gas and electricity appliances. These were shown in great variety; the arrangements being carried out by the Gas Engineer (Mr. W. Langford). The exhibition was opened by the Mayoress (Mrs. G. Bennion). In connection with the gas section, Mrs. E. A. Springthorpe gave cookery lectures twice daily. There are now 1516 cooking-stoves in use in the borough.

Messrs. Donald Macpherson and Co., Limited, of Manchester, have received instructions from Mr. Thomas Glover, the Engineer of the Norwich Gas-Works, to paint the whole of the holders, scrubbers, &c., by the compressed-air process.

An interesting lecture on "Coal and its Products" was recently given in the Kingston Club, by Mr. J. Armitage Drake, head of the firm of Drakes, Limited, who is a member of the Halifax Corporation. There was a capital attendance, including several members of the Town Council, and the Mayor (Alderman Josiah Wade), who presided. A gas plant in miniature had been erected, and by means of this, assisted by his son, Mr. W. A. Drake, the lecturer explained the processes followed in the manufacture of gas. In fact, gas was actually made; and a very good illuminant it was. Samples of different qualities of coal were produced, and their gas-making properties duly explained; the information being made all the easier to follow by carefully prepared diagrams. The lecture was listened to with the greatest interest; and at its close Mr. Drake was accorded a hearty vote of thanks.

We have received from Messrs. Richmond and Co., a copy of their "Domestic and Economical Cookery Recipes, with Special Hints on Gas Cooking," which is an excellently printed and neatly cloth bound treatise on the subject indicated by the title. It is a new, revised, and enlarged edition of the book published by the firm in 1897—making thirty thousand copies—and contains no less than 652 recipes, together with hundreds of illustrations, which make it quite a pleasure to turn over the 300 pages occupied. At the end of the work, the advantages of cooking and heating by gas are set forth in a way that should appeal to those who are still old-fashioned enough to use coal-fires in districts where gas is to be obtained at anything like a reasonable rate. Not the least of the advantages of the book is the fact that all the recipes and instructions are set out in the simplest language possible; so that he (or she) who reads may understand, and as the cost is only 2s. 4d. post free, it is within the reach of all. We feel sure nobody who buys a copy will regret the outlay. It should very soon be necessary to print a still further number of copies of so useful a companion to that familiar friend the gas-cooker.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

CARBONIZING FOREMAN. No. 4c24.
FITTER (Head). Nuneaton Gas Company.
MANAGER AND COLLECTOR. Skegness Gas Company. June 5.
STOKERS. Bognor Gas-Works.

Situation Wanted.

TRAVELLER GAS-STOVE TRADE. W. W. Faversham.

Pupil.

DONCASTER GAS-WORKS.

Plant, &c., for Sale.

PURIFIERS, &c. Little Sutton Gas-Works.
PURIFIERS, &c. Nantwich Gas-Works.
PURIFIERS, VALVES, HYDRAULIC MAIN, GASHOLDER, &c. Pitlochry Gas Company.
RETORT FITTINGS, &c. Sutton (Surrey) Gas Company.
VALVE (8-inch). Sutton (Surrey) Gas Company.

Plant (Second-Hand) Wanted.

PURIFIERS (2). Girvan Gas Company.

Meeting of Company.

PORTSMOUTH WATER COMPANY. May 21.

Sales of Stocks and Shares.

EAST LONDON WATER COMPANY. May 26.
GORING AND STREATLEY GAS AND WATER COMPANY. May 6.
GREAT YARMOUTH WATER COMPANY. May 12.
HORLEY GAS COMPANY. May 6.
NEWHAVEN AND SEAFORD WATER COMPANY. May 27.
TOTTENHAM AND EDMONTON GAS COMPANY. May 12.

TENDERS FOR

Ammoniacal Liquor.

ACCRINGTON GAS AND WATER BOARD. Tenders by May 12.

Benzol.

WILMSLOW, &c., GAS COMPANY. Tenders by May 12.

Boilers.

ABERCARN GAS DEPARTMENT. Tenders by May 1.

Brass and Copper Fittings, &c.

PERTH GAS DEPARTMENT. Tenders by May 11.

Building (Retort and Engine House, &c.).

ABERCARN GAS DEPARTMENT. Tenders by May 1.

Cement.

PERTH GAS DEPARTMENT. Tenders by May 11.

Coal and Cannel.

BARNOLDSWICK GAS DEPARTMENT. Tenders by May 1.
BARROW-IN-FURNESS GAS DEPARTMENT. Tenders by May 13.
DENTON GAS DEPARTMENT. Tenders by May 6.
LIVERPOOL GAS COMPANY. Tenders by May 16.
PERTH GAS DEPARTMENT. Tenders by May 11.
SANDWICH GAS DEPARTMENT. Tenders by May 27.
STOURBRIDGE GAS DEPARTMENT. Tenders by May 12.
WILMSLOW, &c., GAS COMPANY. Tenders by May 12.

Cookers.

WILMSLOW, &c., GAS COMPANY. Tenders by May 12.

Exhauster and Engine.

ABERCARN GAS DEPARTMENT. Tenders by May 1.

Gasholder Tank.

CATERHAM GAS COMPANY. Tenders by May 7.

Gasholders.

CATERHAM GAS COMPANY. Tenders by May 7.
NEW MILLS GAS DEPARTMENT. Tenders by May 5.

General Stores, Oils, Paints, &c.

PERTH GAS DEPARTMENT. Tenders by May 11.
WILMSLOW, &c., GAS COMPANY. Tenders by May 12.

Lime.

PERTH GAS DEPARTMENT. Tenders by May 11.

Meters, &c.

PERTH GAS DEPARTMENT. Tenders by May 11.
WILMSLOW, &c., GAS COMPANY. Tenders by May 12.

Pipes and Fittings, &c.

LEIGH (Lancs.) WATER DEPARTMENT. Tenders by May 16.
PERTH GAS DEPARTMENT. Tenders by May 11.

Pyrites Acid.

PERTH GAS DAPARTMENT. Tenders by May 11.

Retort Bench, Fittings, &c.

ABERCARN GAS DEPARTMENT. Tenders by May 1.

Tar.

ACCRINGTON GAS AND WATER BOARD. Tenders by May 12.
STOURBRIDGE GAS DEPARTMENT. Tenders by May 12.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale than all other Oxides combined.
SPENT OXIDE purchased in any district.
JOHN WM. O'NEILL, Managing Director,
160, 161, & 162, PALMERSTON HOUSE,
LONDON, E.C.

ANDREW STEPHENSON, AGENT. All communications RE OXIDE to the COMPANY as above.

WINKELMANN'S
"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
ANDREW STEPHENSON, 182, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

BROTHERTON & CO., LIMITED.
Offices: Commercial Buildings, LEEDS. Correspondence invited.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 45 & 47, Westminster Bridge Road, LONDON, S.E.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Addresses:
"Braddock, Oldham." "Metrique, London."

DUTCH OXIDE OF IRON.

EERSTE Hollandsche Yzererts Maaty
(First Dutch Bog Ore Company, Ltd.), ROTTERDAM.
General Manager for England and Wales—
CHARLES E. FRY, LEAMINGTON; and at Tower Chambers, Brown Street, MANCHESTER.
London Managers—
E. PADFIELD & CO., 96-98, Leadenhall Street, LONDON, E.C.
General Manager (for Scotland)—
J. B. MACDERMOTT, 11, Bothwell St., GLASGOW.

COAL GAS TAR wanted.
Gas Managers in Gloucester, Somerset, Worcester, Devon, Wilts, Hereford, Monmouth, and Glamorgan PLEASE NOTE. BEST PRICE offered, either on Fixed or Sliding-Scale Basis.
State Quantity to offer for Prompt and Forward Delivery.
The SHARPNESS CHEMICAL COMPANY, Tar Distillers, Sharpness Docks, GLOS.

OXIDE OF IRON.

FIRE CEMENT PAINT, GAS COAL.
BALE & CHURCH, 5, CROOKED LANE, LONDON, E.C.

SULPHURIC ACID for Sale.
BROTHERTON AND CO., LTD., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

DO YOU WANT BEST CARBONIZING RESULTS?

IF SO ADOPT

WADDELL'S REGENERATOR

ADOPTED AT

ARBROATH
ANNAN
BUXTON
BROUGHTY FERRY
COWDENBEATH
DUNFERMLINE
DARWEN
ENNISCORTHY
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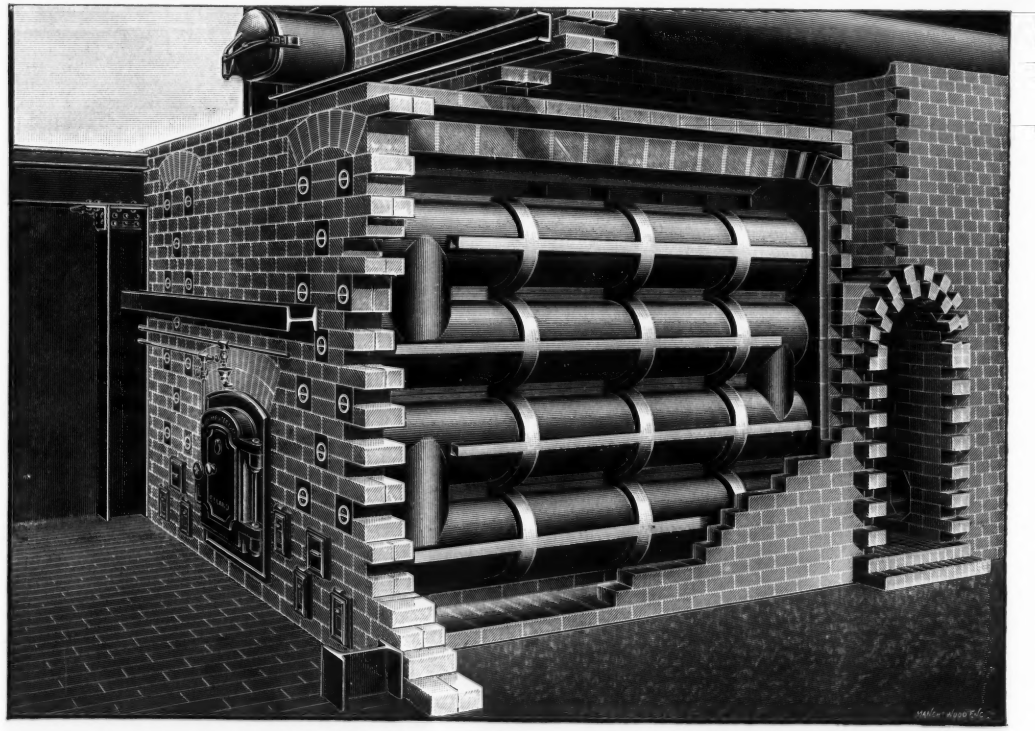
GRANTHAM
LONG EATON
SHREWSBURY
SKELMANTHORPE
TEIGNMOUTH
WALTON-ON-THAMES
WATH-ON-DEARNE
WORTHING
&c.



VIEW SHOWING WASTE HEAT TUBES AND SECONDARY AIR TRAVEL
(WITH OR WITHOUT PROJECTING FURNACE.)

NO SHORT CIRCUITING.

MAXIMUM HEATING SURFACE FOR SECONDARY AIR.

STRONG IN DESIGN.

EVERY FLUE CAN BE EXAMINED.

ANY DESIRED HEAT OBTAINED.

LOWEST FUEL CONSUMPTION.

RESULTS GUARANTEED.

SOLE AGENTS—

R. DEMPSTER & SONS, Ltd.,

ELLAND.

Printed for WALTER KING, by King, Sell, and Olding, Ltd.; and published by him at 11, BOLT COURT, FLEET STREET, in the CITY OF LONDON.—Tuesday, April 28, 1903.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."

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All Communications, Remittances, &c., to be addressed to
WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.
Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.

HYDRATED OXIDE OF IRON.

PREPARED from Pure Iron.

Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Lent on Hire.
Can be Exchanged for Spent Oxide.
READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

AMMONIACAL LIQUOR wanted.

BROTHERTON AND CO., LTD., Ammonia Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SULPHATE OF AMMONIA

SATURATORS and LEAD WORK for Sulphate of Ammonia Plants.

For REPAIRS or ALTERATIONS, ring up "0848 BOLTON," or Telegraph "SATURATORS, BOLTON."

Largest Practice and most Up-to-Date Works in Britain.

JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.

GAS TAR wanted.

BROTHERTON AND CO., LTD., Tar Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

NEW GAS PLANT CEMENT.

JOHN E. WILLIAMS AND CO.

VICTORIA PAINT WORKS,
MANCHESTER.

For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

PATENTS AND TRADE MARKS

PUBLICATIONS. "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; "SUBJECT-MATTER of PATENTS," 6d.

MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

AMMONIACAL Liquor wanted by

JOHN RILEY & SONS, Hapton, near ACCRINGTON.

IT is worth your while to buy direct.

THE RELIANCE LUBRICATING OIL COMPANY 19 and 20, Water Lane, Great Tower Street, London, E.C., handle all kinds of Lubricating Oils, for Engines, Cylinders, Dynamos, Spindles, &c., Burning Oils, Solar Distillates, Carburetting Oils, and Spirits for Gas Making; Motor Oils, Fuel Oils, Animal, Fish, and Vegetable Oils, &c., for all purposes. Write for our "Trade Mark" Inkstand, sent free to customers. Non-customers, 2s. 6d. each. RELIANCE LUBRICATING OIL COMPANY, London, Glasgow, Newcastle-on-Tyne, &c. Established 1858. Telegraphic Address: "Substral," London; A.B.C. Code used. Telephone No.: Avenue 5891.

PENNY-IN-THE-SLOT WORK.

H. GREENE & SONS, Ltd., are prepared to give QUOTATIONS to Gas Companies or Corporations for FITTING UP COMPLETE and CARRYING OUT the WORK in its entirety, either in Iron or Compo.

SURREY ENGINEERING WORKS, BLACKFRIARS ROAD, LONDON, S.E.
Telephone: 1693 HOP. Telegrams: "LUMINOSITY."

"A RAY OF LIGHT" and "HEAT RAYS." Both Pamphlets now in THIRD EDITION; nearly 120,000 copies having been sold since first publication last year.

Special abridged edition of "HEAT RAYS" for small Country Gas Undertakings not in competition with Electricity—Gas for Cooking, Heating, and Power. 4s. 6d. per 100.

T. E. PYE, Gas-Works, SANDWICH.

TO GAS AND WATER OFFICIALS.

COURT ROYAL CYCLES are largely supplied to Public Officials. Specially REDUCED PRICES to GAS MANAGERS and ASSISTANTS where unrepresented. See and test one of these sterling high-grade Manufactures before deciding upon any new purchase. Large Catalogue, Books of Testimonials, and Special Prices sent, on application, from the Makers LLOYD COURTS AND CO., COVENTRY.

THE EVESON COAL AND COKE COMPANY, LIMITED, BIRMINGHAM,

ASK for Prices of Gas Coke in any quantities, delivered into waggons at Sellers' Station.

TRAVELLER, with good connection in South-Eastern Counties, lately representing good Firm, desires re-engagement. Excellent References. Age 27.

Address W. W., 83, Preston Street, FAVERSHAM.

WANTED, Two second-hand Purifiers, in good repair. Size, about 9 or 10 feet square by about 5 feet, inside measurements.

State Price and give Full Particulars to SECRETARY, Gaslight Company, GIRVAN.

THE Gas Committee of the Corporation of Doncaster have a VACANCY at their Gas-Works for a PREMIUM PUPIL.

Particulars on application to the ENGINEER, Gas-Works, DONCASTER.

WANTED, at once, Two Steady Reliable STOKERS, about 30 years of age, used to Shovel Charging, and accustomed to Engine and Boiler. Wages 34s. per week; and coke fuel allowed in the Winter. Personal interview by arrangement.

Address W. HAMMOND, Manager and Secretary, Gas-Works, Bognor, SUSSEX.

HEAD FITTER, &c.

WANTED, a thoroughly Practical and Intelligent MAN to TAKE CHARGE of Gas-Fitters and Main and Service Layers.

The Applicant must be prepared to do Fitting work himself; and he must provide a bicycle for use in connection with his work. He must understand something of Gas-Engines, be able to estimate work, and be a good disciplinarian. Only reliable Men of the first-class need apply.

The MANAGER, Gas-Works, NUNEATON.

CARBONIZING FOREMAN.

WANTED, immediately, a thoroughly practical Man as CARBONIZING and YARD FOREMAN for a Works manufacturing 400 million cubic feet per annum. Must understand Inclined Retort Settings and Regenerative Furnaces and the general routine of a Gas-Works. House, Coal, and Gas provided.

Apply, by letter, stating lowest Wages required, to No. 4024, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SKEGNESS GAS-LIGHT AND COKE COMPANY, LIMITED.

WANTED, a Manager and Collector for the above Company.

Applicant must have had thorough and practical experience in Gas Manufacture, Distribution, Main Laying, &c., and be able to keep Works Books, make Reports, &c.

Salary £110 per annum; no house. Good opening for smart, energetic Man.

Present make about 9 million cubic feet per annum.

Applications, stating Age, Experience, present employment, and enclosing copies of recent Testimonials, to be sent to us not later than the 5th of June, 1903.

By order,
TWEED STEPHEN AND DASHPER,
Solicitors and Secretaries.

Skegness, April 27, 1903.

GAS-METERS wanted, old disused Wet. Copper Lamp Frames, Brass, Pewter, Tin, Zinc, Lead Ashes, Old Copper Electric Cable, &c., for Cash.

J. SMITH, Canal Road, BRADFORD.

TO BE SOLD—Purifiers, Two or Four, 10 feet square by 4 ft. 6 in. deep, planed Joints, Connections, and Overhead Girders.

Write J. WRIGHT, 181, QUEEN VICTORIA STREET, E.C.

FOR SALE - Four 9 feet square Purifiers, complete with 8-inch Centre-Valve, Connections, and Lifting Apparatus. In very good condition. Can work three or four Purifiers as desired. Can be seen at work.

For further Particulars, apply to J. DAVIES, Gas-Works, NANTWICH.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.

J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

FOR SALE—Very good Gas Plant as under:—

PURIFIERS—Four 12 feet square, with 8-inch Centre-Valve and Connections. Planed Joints.
Kirkham WASHER-SCRUBBER, 300,000 cubic feet per diem, with Engine and 8-inch Valves and Connections.
Livesey WASHER, 250,000 cubic feet per diem, with 8-inch Valves and Connections.

Photos. sent on application to SAML. WHILE AND SON, 60, Queen Victoria Street, LONDON, E.C.

FOR SALE—

50 18-in. by 15-in. D RETORT MOUTHPIECES, fitted with Tangye Patent Lids, 6-inch Outlets.
30 18-inch Round RETORT MOUTHPIECES, fitted with Tangye Patent Lids, 6-inch Outlets.
3 Lengths of Cast Iron HYDRAULIC MAIN, with 4-inch Outlet and Valves.
18 6-inch ASCENSION, ARCH, and DIP PIPES for above, with 50 feet of 8-inch FOUL MAIN and Connections complete.
1 8-inch Donkin VALVE.

For further Particulars, apply to G. M. ROBINS, Gas Offices, Sutton, SURREY.

FOR SALE—Three 5-feet Square Purifiers, in good condition. Complete with Centre-Valve, 5-inch Connections, and Lifting Screws for Cover.

Apply to the MANAGER, Gas-Works, Little Sutton CHESHIRE.

FOR SALE—Two Purifiers, 6 feet square, and Two 6-inch FOUR-WAY VALVES, with all Fittings Complete; (2) Steel HYDRAULIC MAIN, 13 ft. by 18 in. by 18 in., U-shaped, suitable for two, four, or six Retorts, with Dip-Pipes and Cradles Complete (almost new); and (3) Old GASHOLDER, 12 ft. by 25 ft., with Three Columns and Fittings Complete.

Apply to the GAS MANAGER, Pitlochry New Gaslight Company, Limited, PITLOCHRY.

PERTH GAS DEPARTMENT
CONTRACTS, 1903-4.

COAL, LIME, PYRITES ACID, C.I. and M.I. PIPES, BRASS and COPPER WORK, METERS, PAINTS, OILS, CEMENTS, GENERAL STORES and SUNDRY FURNISHINGS.

Mr. John Begg, Town Clerk, will receive sealed and endorsed TENDERS for the above on or before Monday, the 11th, prox., at Ten a.m.

Specifications, Schedules, and full Particulars from the undersigned.

W. B. MCLUSKY,
Engineer and Manager.

Perth, April 25, 1903.

NEWHAVEN AND SEAFORD WATER COMPANY.

THE Directors of the above Company are prepared to receive, on or before Twelve o'clock noon of Wednesday, the 27th day of May, 1903, further sealed TENDERS for the purchase of the SHARES remaining unsold of the 500 Ordinary "B" Shares of and in the Undertaking of the above-named Company.

Particulars of Sale and Form of Tender may be had on application to the Secretary, Claremont Road, Seaford.

By order of the Directors,
JOHN T. BICKFORD,
Secretary.

BOROUGH OF LEIGH.
(WATER DEPARTMENT.)

THE Gas and Water Committee of the above Corporation invite TENDERS for the supply and delivery of about 3500 yards of 16-inch diameter Cast-Iron Socket and Spigot PIPES and SPECIALS.

Specification, Forms of Tender, and any further Particulars may be obtained on application to the Engineer, Mr. James Gibson, Gas and Water Works Offices, Leigh, Lancashire.

Sealed Tenders to be delivered to me the undersigned not later than Twelve o'clock noon on Saturday, the 16th day of May, 1903.

By order,
PEREGRINE THOMAS,
Town Clerk.

Town Hall, Leigh, Lancs.,
April 21, 1903.

BOROUGH OF BARROW-IN-FURNESS.

SUPPLY OF COAL AND CANNEL.

THE Corporation are prepared to receive TENDERS, on Forms to be obtained at the Office of the Gas and Water Manager, for the supply of Screened GAS COAL and CANNEL, for the Year ending the 30th of June, 1904.

Tenders, addressed to the Chairman of the Gas and Water Committee, and endorsed "Tender for Coal," to be delivered at the Town Clerk's Office not later than Twelve o'clock noon on Wednesday, the 13th day of May, 1903.

The lowest or any Tender not necessarily accepted.

By order,
C. F. PRESTON,
Town Clerk.

Town Hall, Barrow-in-Furness,
April 23, 1903.

WILMSLOW AND ALDERLEY EDGE GAS COMPANY.

THE Directors of the above Company invite TENDERS for their requirements, as under, for the Year ending June 30, 1904—viz.,

GAS COAL and CANNEL, delivered at Wilmslow Station; GAS-METERS (Dry), GAS-COOKERS, BENZOL, and MACHINERY OIL, delivered at the Company's Works. Also CARTING for One, Two, or Three Years.

Particulars as to quantities required, copies of Specification, and Forms of Tender, can be had (in writing only) from the undersigned.

Sealed Tenders, endorsed "Tender for ——," must be sent not later than Tuesday, May 12, 1903, to W. H. Welsh, Esq., Secretary, 52, Brown Street, Manchester.

The Directors do not bind themselves to accept the lowest or any Tender.

WM. SEVERS,
Engineer and Manager.

Gas-Works, Wilmslow,
April 22, 1903.

BARNOLDSWICK URBAN DISTRICT COUNCIL.

(Gas and Water Department.)

THE above Council invite Tenders for the supply of 2700 Tons of screened GAS COAL for the year ending June 30, 1904.

Tenders to be sent in on or before Friday, May 1, 1903.

Particulars and Form of Tender may be obtained from the undersigned.

Harry Scott,
Engineer and Manager.

Town Hall,
Barnoldswick, Yorkshire.

URBAN DISTRICT COUNCIL OF STOURBRIDGE.

(Gas Department.)

THE Gas Committee invite Tenders for the supply and delivery of 17,000 Tons of Good screened GAS COAL.

Forms of Tender may be had on application to the undersigned; and only offers on our own form will be considered.

Tenders, endorsed "Gas Coal," addressed to the Chairman of the Gas Committee, to be sent to me at the Gas-Works, Stourbridge, on or before Tuesday, May 12, 1903.

The lowest or any Tender not necessarily accepted.

By order,
Wm. North,
Engineer and Manager.

Stourbridge Gas-Works,
April 25, 1903.

URBAN DISTRICT COUNCIL OF STOURBRIDGE.

(Gas Department.)

THE Gas Committee invite Tenders for the purchase of their surplus TAR for the Twelve Months ending June 30, 1904.

Tenders, endorsed "Tar," addressed to the Chairman of the Gas Committee, and sent to me at the Gas-Works, Stourbridge, on or before Tuesday, May 12, 1903.

The highest or any Tender not necessarily accepted.

By order,
Wm. North,
Engineer and Manager.

Gas-Works, Stourbridge,
April 25, 1903.

CATERHAM AND DISTRICT GAS COMPANY.

GASHOLDER AND STEEL TANK.

THE Directors are prepared to receive TENDERS for the construction of a TELESCOPIC GASHOLDER, 86 feet mean diameter and 20 feet deep, in a STEEL TANK, 90 feet diameter and 20 feet deep.

Drawings may be seen, and Specifications obtained, upon application to Messrs. H. E. Jones & Son, Palace Chambers, Westminster, S.W., or to the Manager, Gas-Works, Whyteleafe, Surrey.

Tenders, sealed and endorsed "Tender for Gasholder," addressed to the Chairman, to be delivered at the Company's Office, on Thursday, May 7.

The Directors do not bind themselves to accept the lowest or any Tender.

By order,
D. H. Anderson,
Secretary and Manager.

Gas-Works, Whyteleafe, Surrey.

BOROUGH OF SANDWICH.

TENDERS FOR GAS COAL.

THE Corporation invite Tenders for the supply of 1500 Tons of Best GAS COAL, to be delivered in good and dry condition, at such times and in such quantities as may be required during the period between the 30th of June, 1903, and the 31st of July, 1904.

Sealed Tenders (accompanied by Analyses), endorsed "Tenders for Coal," must reach the Town Clerk, Potter Street, Sandwich, on or before Wednesday, the 27th of May next.

Tenders to state alternative prices for Coal—

(1) Free on board Corporation vessel.
(2) Delivered alongside quay adjoining Corporation Gas-Works, on the River Stour, in vessels of 200 to 250 Tons
(3) Delivered in Trucks S.E. Station, Sandwich.

No Tender Forms issued.

The Corporation do not bind themselves to accept the lowest or any Tender.

By order,
T. Ebenezer Pye,
Manager,

Gas Office, April 16, 1903.

LIVERPOOL UNITED GASLIGHT COMPANY.

TENDERS FOR CANNEL AND COAL.

THE Directors of the Liverpool United Gaslight Company are prepared to receive TENDERS for the supply of 30,000 Tons of CANNEL, and 220,000 Tons of COAL, to be delivered at the various Works of the Company during the period of Twelve Months, between the 1st of July, 1903, and the 30th of June, 1904.

Tenders will be received for the whole or any portion of the above quantity.

The Directors reserve the right to accept Tenders for the whole or any portion of the quantity offered, and do not bind themselves to accept the lowest or any Tender.

Full Particulars and printed Forms of Tender can be obtained on application to the undersigned, at the Gas Office, Duke Street, Liverpool, to whom Tenders (on the printed Form only) must be delivered, at or before Ten a.m., on Saturday, May 16, endorsed "Tender for Cannel and Coal."

By order,
William King,
Engineer.

Gas Office, Duke Street,
Liverpool, April 15, 1903.

DENTON URBAN DISTRICT COUNCIL.

(Gas Department.)

COAL.

THE Gas Committee invite Tenders for the supply of COAL; the same to be sent in on or before the 6th of May inst.

Specification and Form of Tender to be obtained from the Gas Engineer, Mr. J. Chadwick Smith, Gas-Works, Denton, near Manchester.

The Committee do not bind themselves to accept the lowest or any Tender.

By order.
William Richards,
Clerk of the Council.

April 23, 1903.

DENTON URBAN DISTRICT COUNCIL.

(Gas Committee.)

TAR.

THE Gas Committee invite Tenders for TAR; the same to be sent in on or before the 6th of May inst.

Particulars may be obtained from the Gas Engineer, Mr. J. Chadwick Smith, Gas-Works, Denton, near Manchester.

The Committee do not bind themselves to accept the highest or any Tender.

By order,
William Richards,
Clerk of the Council.

April 23, 1903.

ACCRINGTON DISTRICT GAS AND WATER BOARD.

THIS Board invite Tenders for the surplus TAR and AMMONIACAL LIQUOR which may be produced at the Accrington and Great Harwood Works of the Board, during the Year from the 1st of July next to the 30th of June, 1904.

The estimated quantity of Tar is 1800 Tons, and Liquor 5000 Tons.

Sealed Tenders, endorsed "Tar and Liquor," addressed to the Chairman of the Board, must be in my hands on or before Tuesday, the 12th of May

Forms of Tender may be obtained on application.

By order,
Charles Harrison,
General Manager.

General Offices, Accrington,
April 15, 1903.

ABERCARN URBAN DISTRICT COUNCIL

GAS-WORKS EXTENSIONS.

THE Gas Committee of the above Council invite TENDERS for the following Extensions at their Gas-Works, Abercarn:—

Tender No. 1—Construction of Buildings for a RETORT-HOUSE, with Excavation and Foundations for a Bench of Retorts, ENGINE-HOUSE and BOILER-HOUSE, with all contingent works necessary to the completion of the said Buildings.

Tender No. 2—RETORT-BENCH of Three single Arches of Shallow Regenerative Furnaces and 21 Retorts, with all Fittings complete.

Tender No. 3—Vertical STEAM-BOILER and MOUNTINGS.

Tender No. 4—ENGINE and EXHAUSTER.

The work is to be carried out in accordance with the Drawings and Specifications prepared by the Engineer, Mr. Thomas Canning, Assoc.M.Inst.C.E., Mill Street, Newport, Mon., at whose Office the Drawings can be seen and Further Information obtained.

Copies of Specifications for Tenders Nos. 3 and 4, and Forms of Tender for Nos. 3 and 4, can be obtained on application to the undersigned on the payment of One Guinea, which will be returned by the Council on receipt of a *bonâ-fide* Tender. Nos. 1 and 2 Forms of Tender only supplied without deposit.

The Gas Committee do not bind themselves to accept the lowest or any Tender.

Sealed Tenders, endorsed "No. 1, 2, 3, or 4," to be received by the undersigned not later than Twelve o'clock noon on Friday, the 1st of May, 1903.

T. S. Edwards,
Clerk to the Council.

24, Stow Hill,
Newport, Mon.

EAST LONDON WATER-WORKS COMPANY.

ISSUE OF £200,000 THREE PER CENT. DEBENTURE STOCK

Created under the East London Water-Works Act, 1900.

NOTICE is Hereby Given, that it is the intention of the Directors to offer for public TENDER the sum of £200,000 THREE PER CENT. DEBENTURE STOCK (less Income-Tax) under the East London Water-Works Act, 1900, redeemable at par after the expiration of 25 years from the date of issue, subject to Six Months' Notice being given by the Company.

This Stock is a legal investment for trustees, and ranks with the other Debenture Stock of the Company for payment of interest, and has priority over the Ordinary Stock (amounting to £1,720,560).

Tenders to be delivered at the Company's Offices, 15a, St. Helen's Place, E.C., not later than One o'clock p.m. on Tuesday, the 26th of May, 1903.

The purchase money to be paid to the Company's Bankers on or before the 4th of June, 1903, but the allottees will have the option of paying half the amount of the purchase money on that date, and half on Thursday, the 16th of July, 1903.

Seven Months' Interest will be payable on the 1st of January, 1904, in respect to the sums paid on the 4th of June, 1903, and Six Months in respect to the sums paid on the 16th of July, 1903.

Full Particulars and Conditions may be obtained at the Offices, or will be forwarded on application.

By order,
I. A. Crookenden,
Secretary.

15a, St. Helen's Place, E.C.
April 24, 1903.

NEW MILLS URBAN DISTRICT COUNCIL.

(Gas Department.)

TO GASHOLDER MAKERS.

THE above Council are prepared to receive TENDERS for TELESCOPING GASHOLDER, with Outer Lift, 63 feet diameter by 20 feet deep, with Guide-Framing.

Plan and Specification can be seen, and all Information obtained, from Mr. J. R. Mackenzie, Gas Manager.

Tenders, endorsed "Gasholder," to be sent to me the undersigned not later than May 5, 1903.

The Council do not bind themselves to accept the lowest or any Tender.

Joseph Pollitt,
Clerk to the Council.

Town Hall, New Mills,
April 16, 1903.

ISSUES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his ISSUES by AUCTION under PARLIAMENTARY POWERS of STOCKS and SHARES in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing such Capital, and also for including Gas and Water Stocks and Shares belonging to Private Owners in these Periodical Sales, can be obtained on application at Mr. Alfred Richards' Offices, 18, Finsbury Circus, E.C.

HORLEY DISTRICT GAS COMPANY.

£900 ORIGINAL STOCK,

Ranking for a Maximum Dividend of 10 Per Cent. Last Year's Dividend 6 Per Cent.

GORING AND STREATLEY DISTRICT GAS AND WATER COMPANY, LIMITED.

32 £5 (WATER) SHARES AND 20 £5 (GAS) SHARES.

Last Year's Dividend on each Class of Shares 5 Per Cent.

MESSRS. EDWIN FOX & BOUSFIELD will include the above in their next STOCK and SHARE AUCTION, at the Mart, E.C., on Wednesday, May 6, at Two o'clock, in Lots.

Particulars at the Auctioneers' Office, 99, Gresham Street, Bank, E.C.

By order of the Directors of the

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

NEW ISSUE OF £12,500 ADDITIONAL "B" CONSOLIDATED STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, May 12, at Two o'clock precisely, in Lots.

Particulars of the Auctioneer, 18, Finsbury Circus, E.C.

GREAT YARMOUTH WATER-WORKS COMPANY.

SALE BY AUCTION OF 250 £10 ORDINARY SHARES

Ranking for 7 per cent. Dividend, 4 per cent. having been paid on similar Shares in the Company for 6½ Years past. Also £2500 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

The Great Yarmouth Water-Works Company was incorporated 50 years ago for supplying the important Seaport Town of Great Yarmouth and its surrounding Districts; and to keep pace with the increasing demand for Water, this further Capital for the construction of New Works is required.

The Water Revenue has risen from £14,226 in 1897 to £17,765 last year.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, London, E.C., on Tuesday, the 12th of May, at Two o'clock, in Lots, by order of the Directors.

Particulars of Sale, with Form of Instructions for the Auctioneer or Secretary to purchase for Investors unable to attend the auction, obtainable post free of the Secretary of the Company, Great Yarmouth, or of the Auctioneer, 18, Finsbury Circus, E.C.

BOROUGH OF PORTSMOUTH WATER-WORKS COMPANY.

NOTICE OF HALF-YEARLY MEETING.

NOTICE is Hereby Given, that the next HALF-YEARLY MEETING of the Shareholders in this Company will be held at the Company's Offices, Commercial Road, Portsmouth, on Thursday, the 21st day of May, 1903, at Three o'clock in the Afternoon, on the following business:—

To receive the Accounts and Balance-Sheet to the 31st of March last, and the Directors' Report.

To declare Dividends.

To elect Directors and Auditor in place of those retiring by rotation.

And for the transaction of the other Ordinary Business of the Company.

The REGISTER OF TRANSFERS WILL BE CLOSED on and after the 14th day of May, 1903, until after the Meeting.

By order of the Board of Directors,
J. L. Wilkinson,
Secretary to the Company.

Dated the 23rd day of April, 1903.

COKE-BREAKERS

For Hand or Power. On Tooth-cutter or Jaw Principles

Goodwin Barsby & Co., Engineers and Ironfounders, Leicester.

TROTTER, HAINES, & CORBETT, LIMITED,
Brettell's Estate
FIRE-CLAY & BRICK WORKS
STOURBRIDGE.

Manufacturers of GAS-RETORTS GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Special Lumps, Tiles, and Bricks for Regenerative and Furnace Work.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

LONDON OFFICE: R. CULL, 34, OLD BROAD STREET, E.C.

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Gas Companies are solicited to try Samples of the
MIRFIELD
BLACK BED GAS COAL.
Prices and Analysis on application.
MIRFIELD (GAS-COAL) COLLIERY COMPY
RAVENSTHORPE, NEAR DEWSBURY.

THE
"ROTARY"
STATION METER.
Efficiency Demonstrated.
APPLY—
T. G. MARSH,
MAWSON CHAMBERS, DEANSGATE,
MANCHESTER.

REDUCE EXPENSES, INCREASE PROFITS by doing your own Whitewashing or Limewashing.

THE
"EVERTRUSTY"
PNEUMATIC PAINTING, WHITE & LIMEWASHING MACHINE.
Extract from a Recent Inquiry: "I have seen the Machine which you supplied to the Bradford Road Gas-Works, Manchester, with which the Manager there is very highly pleased."

Cost from £3 10s. to £12 10s. "A" size replaces 25 men
Full Particulars on application to
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57, GRACECHURCH STREET, LONDON, E.C.

JOHN HALL & CO.,
STOURBRIDGE,
Manufacturers of
FIRE-BRICKS, LUMPS, TILES,
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And every description of Fire-Clay Goods.
RETORTS CAREFULLY PACKED FOR SHIPMENT.

NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.
QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

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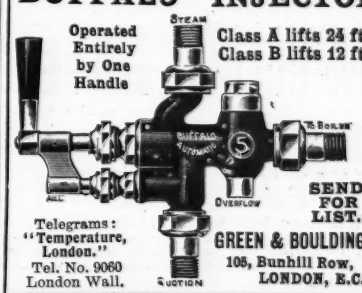
CRESSWELL'S'
When next in want of Cylinder Oil, order just One Barrel of our **ASBESTOCYLIN XXXXX, XXXX, or XXX.** You will certainly continue to use it. Approved by Hundreds of Users. Ask for No. 6 Catalogue.
Cresswell's Asbestos Co., Ltd.,
Wellington Mills, Bradford, Yorks.
Telephone No. 950.
Tel. Address: "Asbestos, Bradford."
Applications for Colonial and Foreign Agencies desired.

'BUFFALO' INJECTOR
Operated Entirely by One Handle
Class A lifts 24 ft.
Class B lifts 12 ft.


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"VERITAS"

Have proved the most successful for Street Lighting and Maintenance.

AVERAGE LIGHT 95 CANDLES.
KEEP THEIR SHAPE.
WILL STAND ROUGH HANDLING.
LAST LONGEST.

Special Quotations for Large Quantities.

MANTLES for every size BURNER kept in Stock.

Write for our Special List of MANTLES, BURNERS, and SUNDRIES.

FALK, STADELMANN, & CO., LD.
"VERITAS" LAMP WORKS,
83, 85, & 87, FARRINGDON ROAD, LONDON, E.C.

ROBERT MARSHALL,
CANNEL COAL MERCHANT
97, WELLINGTON STREET, GLASGOW.
Prices and Analysis of all the Scotch Cannels on Application.

HEATHCOTE GAS COAL.
Rich in Illuminating Power and Yield of Gas.
Above the Average in Weight and Quality of Coke.
Maintains a High Standard in Residuals.
THE GRASSMOOR CO., LD.,
CHESTERFIELD.

THOMAS TURTON AND SONS, LIMITED,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
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FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS
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AND ENGINEERS' TOOLS GENERALLY.
LONDON OFFICE:
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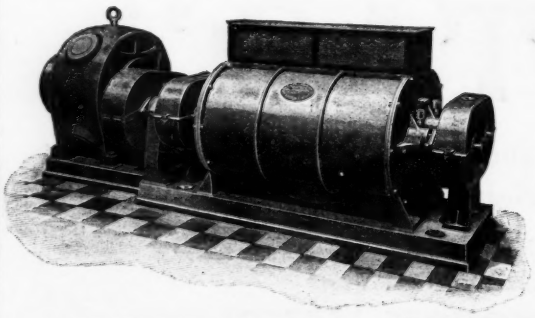
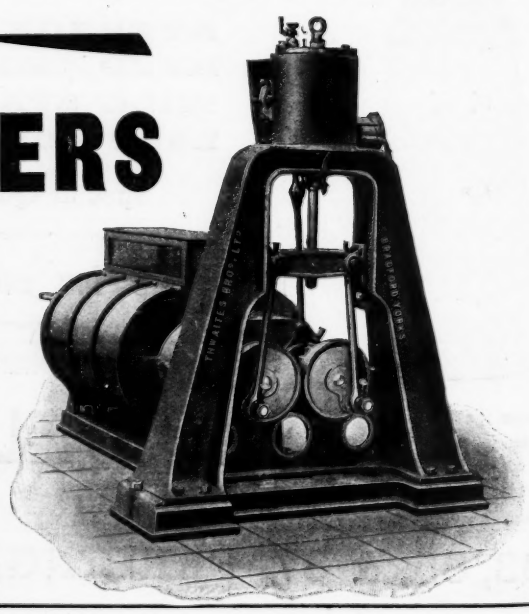
WELDON MUD
FOR
GAS PURIFICATION,
For use in the
RECOVERY OF SULPHUR,
Also Removal of last Traces of
SULPHURETTED HYDROGEN
in catch position.
Full Particulars on application to the Patentees:
GAS DESULPHURIZATION CO.,
— LIMITED, —
1, FENCHURCH AVENUE, LONDON, E.C.

MOBBERLEY & PERRY,
GAS RETORT, FIRECLAY, AND BRICK WORKS,
STOURBRIDGE.
Give SPECIAL and PERSONAL ATTENTION to the execution of all orders
Large Stocks kept.
SPECIALS FOR WATER GAS PLANTS.
Inclined Retorts.

THWAITES BROS., LD.,
MECHANICAL ENGINEERS,
BRADFORD.



ROOTS' BLOWERS
IN ALL SIZES TO DELIVER UP TO
25,000 cubic feet of Air per minute.
Driven by Engine, Belt, or Motor.
SPECIALLY DESIGNED AND OF
MODERN CONSTRUCTION
. . For all Processes of . .
GAS MANUFACTURE.



Recent Progress
. . IN . .
Arc Electric Lighting

The 'enclosed" type of arc light claims to prolong the life of the carbons 15 to 20 times—proportionately reducing the attendance and the carbon bill.

The new Bremer Arc Lamp claims to be over three times as economical as an ordinary Arc Lamp.

Improvements in connection with generating electricity are constantly reducing costs in production.

Electrical Engineers are men of highly technical training, and their industry is helped by the assistance of some of the keenest intellects associated with modern science.

Gas Engineers cannot fight this competition with imaginary or fictitious claims of high efficiency. It is comparatively easy to produce a large unit of Gas Light, it dazzles the eye too, and according to the ignorance of the prospective purchaser, the paper efficiency can be made 30, 40, 100, or 500 candles per foot, *but real efficiency is dependent upon accurate proportions of air and gas, and correct volume to suit the burner.*

These two items, proportion and volume, change with every make of gas. *Inability to meet these conditions must necessarily mean loss of efficiency.*

The Gas Engineer is unquestionably best able to meet the requirements and to extract the full value in light for gas supplied, if he has a controllable supply of air as well as of gas. This we offer in the SCOTT-SNELL LAMP.

We claim that this article meets all the conditions to be fulfilled, and until gas lighting involves some other element at present undreamed of, we offer it to Gas Engineers as the most effective and adaptable instrument for meeting the competition of electric arc lighting.

We make no claim for any specified candle-power per foot (this must necessarily vary with the varying makes of gas), but we do claim to be able to supply THE MAXIMUM OF LIGHT WITH THE MINIMUM OF GAS.

It is an absurdity to take intermediate steps, when you can install the most effective system right away.

The Scott-Snell
Self-Intensifying Gas Lamp Co., Ltd.,
53, VICTORIA STREET, WESTMINSTER, LONDON, S.W.

F. C. SUGDEN & Co.

CARBONIZING SPECIALISTS.

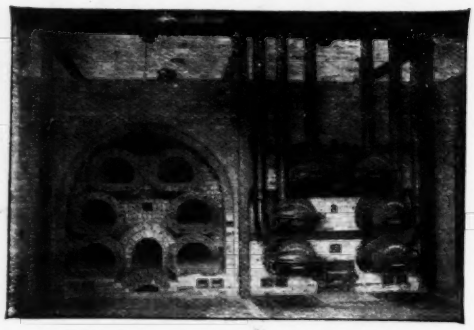


PHOTO. OF REGENERATOR SETTINGS DURING CONSTRUCTION.

REGENERATOR & GENERATOR SETTINGS

DEEP, SEMI-DEEP, AND SHALLOW.

Maximum Make per Ton and Mouthpiece.

Minimum Fuel Consumption.

NUMEROUS REPEAT ORDERS

Have been received for each of the above types of settings.

RESULTS GUARANTEED. RETORTS RESET.

SOLE MAKERS OF **CRIPPS' PATENT CHIMNEY.**

Designs and Estimates on application. 28, EAST PARADE, **LEEDS.**

HARRIS & PEARSON,

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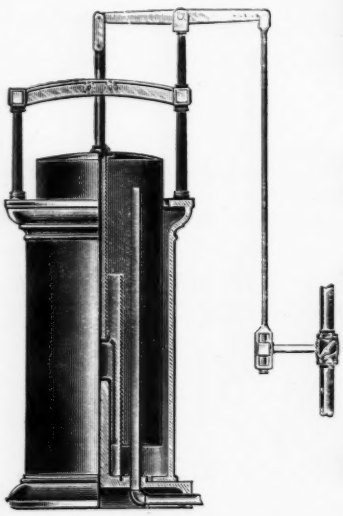
MANUFACTURERS OF

FIRE-CLAY GAS-RETORTS, FIRE-BRICKS, LUMPS, & TILES of Every Description.

GLAZED BRICKS AND PORCELAIN BATHS.



Hydraulic Steam-Regulator

PATENT

for Controlling the supply of Steam to the Engine driving Exhauster according to the make of gas.

The peculiar construction makes it impossible for the Regulator to work other than gradually, as liquid has to pass in or out of a small hole as the Bell rises and falls.

JAMES MILNE & SON, LTD.

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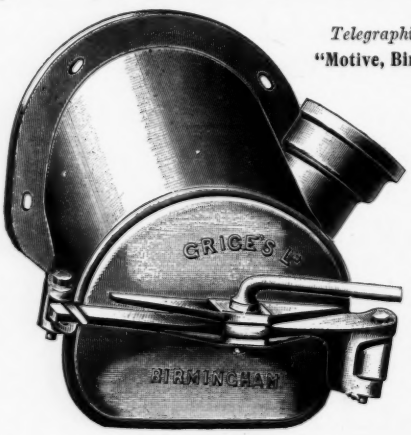
LONDON. GLASGOW. LEEDS.



Telegraphic Address: "Motive, Birmingham."

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FOR

Inclined and Ordinary Retorts.

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Engineers & Gas-Engine Makers,

BIRMINGHAM.

London Office: 25, Victoria St., Westminster. Mr. A. B. Coote, Representative.

Over 400 recently Supplied to the Corporation Gas Department, Saltley, Birmingham.

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Telegrams: "RAGOUT, LONDON." Telephone 273 CENTRAL.

METHANE-HYDROGEN WATER-GAS PLANT.

3 gallons Tar and 20 lbs. Coke produce 1000 cubic feet 10 to 12 Candle Power Gas of the following composition—

Hydrogen	64·4 per cent.
Methane	12·0 „ „
Unsaturated Hydrocarbons	3·0 „ „
Carbon Monoxide	15·0 „ „
Nitrogen and Carbon Dioxide	5·6 „ „
	100·0
Calorific Value	400 B.T.U.

See **Prof. VIVIAN B. LEWES'S** Lecture before Society of Arts, reported in the "JOURNAL OF GAS LIGHTING," Dec. 9, 1902

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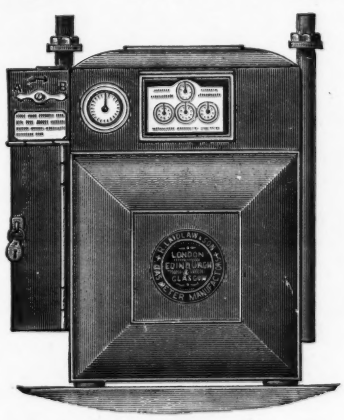

—DRY METER.—

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Patent "NEW"
Scrubber-Washer.

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P. & A. Condensers.

Double Faced
Valves.

Mouthpieces
with
Automatic Catch.

Telegrams:
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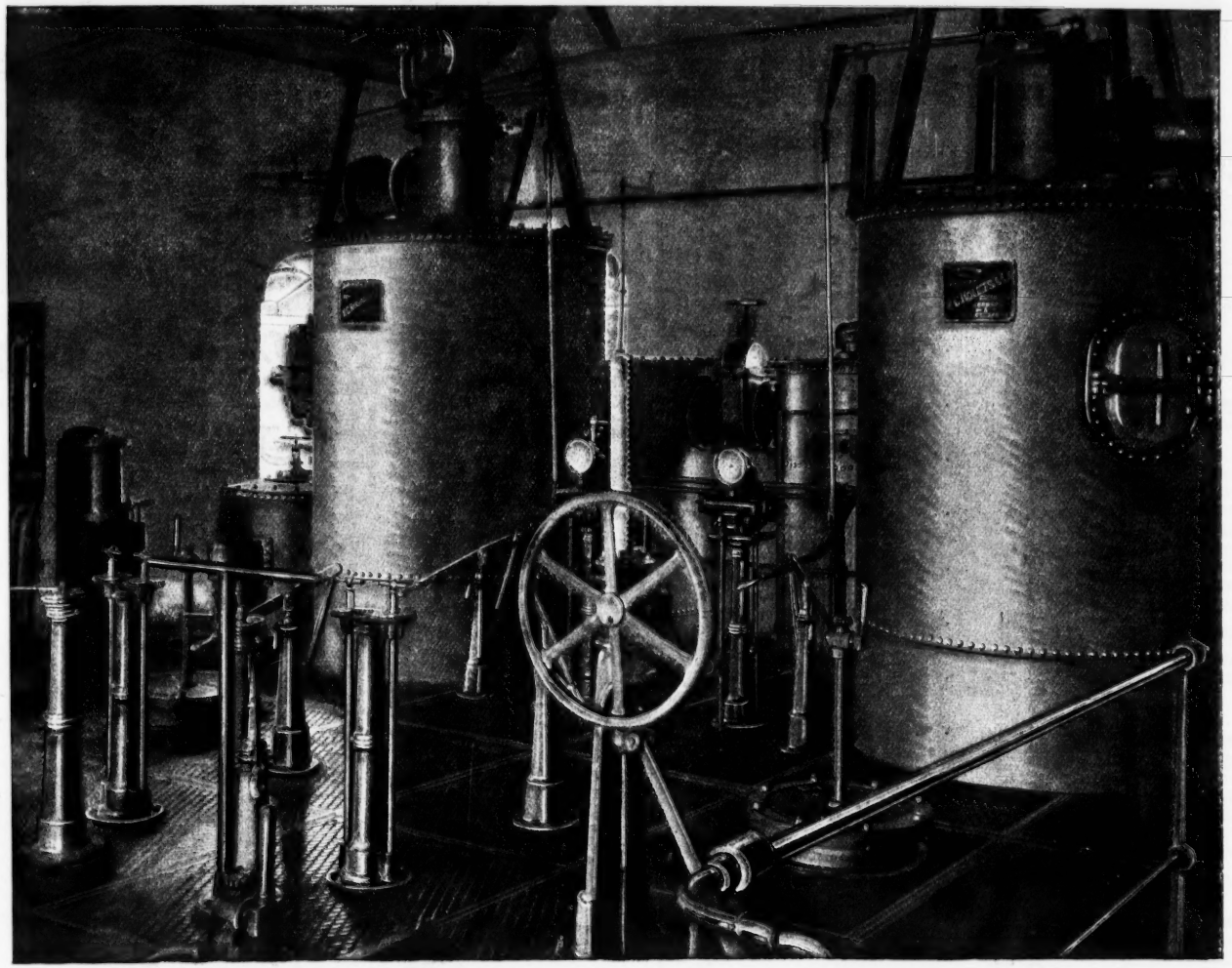

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Erected at LONDONDERRY.

Purifiers.

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Retorts and
Retort Ironwork.

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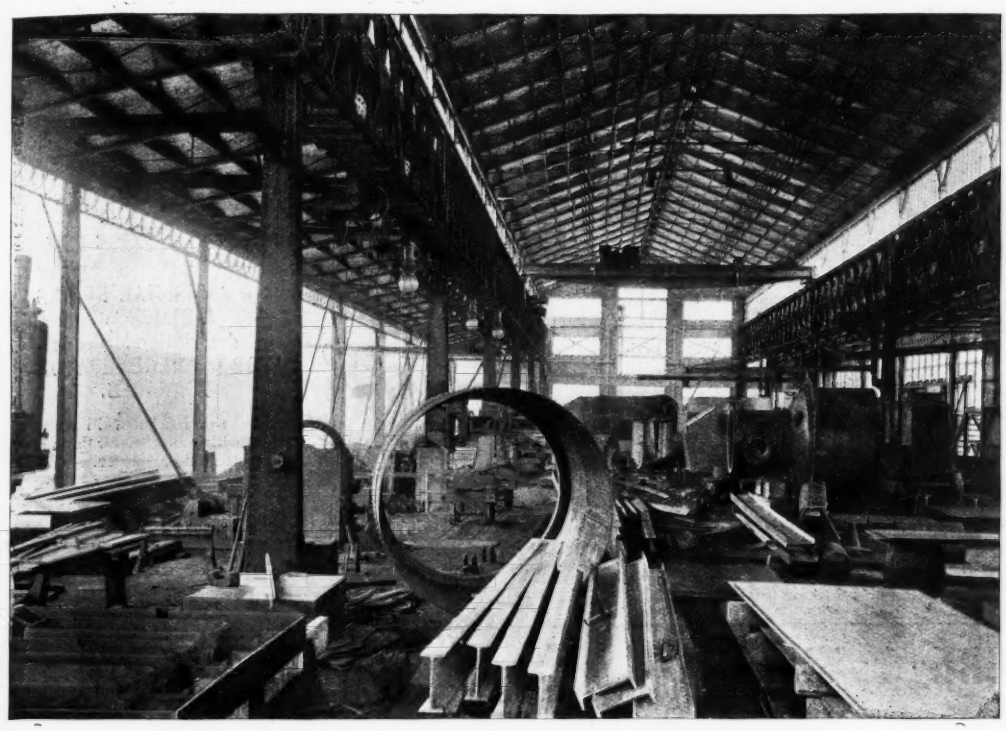

Part View of One of our Construction Shops. (*From a Photo.*)

AND

GAS

PLANT

OF

EVERY

KIND

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UNDER

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ASHMORE, BENSON, PEASE, & CO., LD., STOCKTON-ON-TEES.

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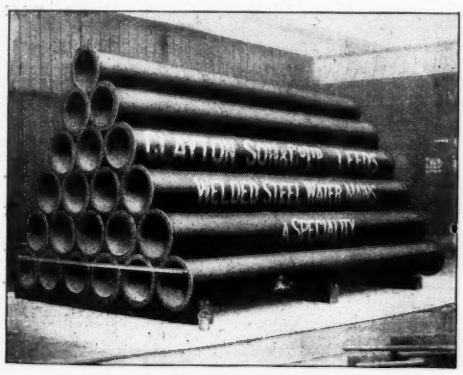

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A SPECIALITY

FOR ALL PURPOSES, TO STAND ANY PRESSURE AND PASS ANY INSPECTION.

CONTRACTS UNDERTAKEN FOR ANY LENGTH OF

PIPE LINE For Water, Steam, Oil, Hydraulic, or Pneumatic Pressure; also for Gas or Air. Any diameter from eight inches upwards.

COMPLETE GAS PLANTS.

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Structural Iron & Steel Work,

HIGH-CLASS BOILERS,

For High Pressures, fitted with DEIGHTON'S PATENT CORRUGATED FLUES, giving increased heating surface and highest economy in working.

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SUPPLY FROM STOCK

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SOCKET-PIPES FOR GAS OR WATER PURPOSES.

FLANGE PIPES FOR STEAM.

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GAS-RETORTS,

Fire-Bricks, Fire-Clay Lumps, and Tiles

OF EVERY DESCRIPTION.

Also Manufacturers of **Cast-Iron Retorts, Iron Mouthpieces, Pipes, and all necessaries for Gas-Works requirements.**

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Machine-Made Retorts

Have been made in large quantities for the last twenty years; and during the whole of that time have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.

Retorts carefully Packed for Export.

Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

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PATENTEES OF
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LOW-PRESSURE HIGH-POWER RECUPERATIVE INCANDESCENT GAS LIGHTING SYSTEM.

DUST & INSECT PROOF.

The highest efficiency yet obtained from Low Pressure Incandescent Gas Lighting without mechanical aid.

Made in suitable sizes and any design to enable Lighting Authorities to successfully compete with Electric Light. Also made as Ventilating Lights.

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25a, HATTON GARDEN, E.C.

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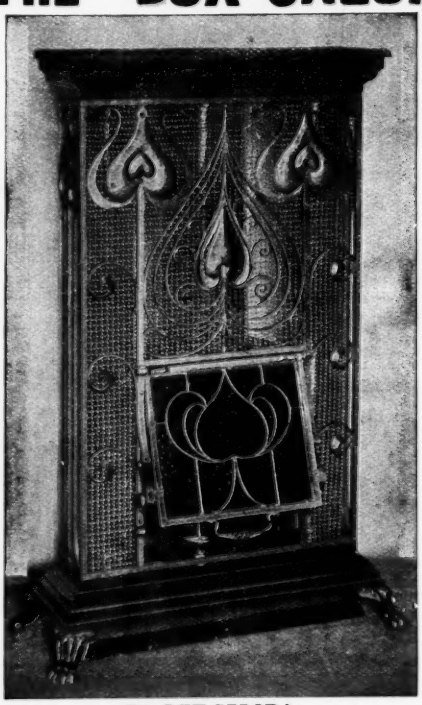

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The "Lux Calors" were the first CONDENSING STOVES on the Market and, after Twenty-Five Yea s' experience, are still first.

Full Particulars and Prices from

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Contractors for Automatic Supplies to the Gaslight and Coke Company and the South Metropolitan Gas Company.

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These REFLECTORS do not CRAZE, and CANNOT GET DISCOLOURED.

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MANUFACTURERS OF
BEST FIRE-BRICKS; INCLINED, HORIZONTAL, and SECTIONAL RETORTS; LUMPS, TILES, &c., of every description.
ESTABLISHED 1860.

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MAKERS OF THE LARGEST GASHOLDER IN THE WORLD ALSO
THE ORIGINAL MAKERS OF
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Telegrams "GAS LEEDS." London Office 60 Queen Victoria St E.C.

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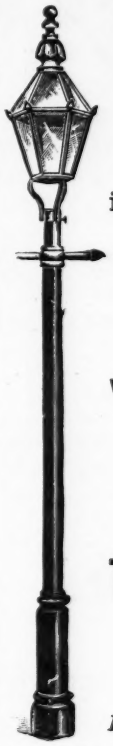

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WELDLESS STEEL TUBING
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Light, Strong, Unbreakable, and Cheap.

GAS, WATER, & STEAM TUBES AND FITTINGS.

WELDLESS STEEL SPIGOT & FAUCET PIPES for Gas and Water Mains.

Tubes can be supplied up to 10 inches diameter and in lengths up to 30 feet.

THE BRITISH MANNESMANN TUBE COMPANY, LTD.,
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Birmingham Depôt: 110, COLMORE ROW.
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The Competitor to be feared in the future is not "Electricity" but

Cheap "Power Gas."

Now is the time to strengthen your position by supplying a good

Illuminating, Heating, and Power Gas at the Lowest Price.

For this purpose

The "Dellwik Plant"
Is a Safe Investment.

SOLE MAKERS FOR THE UNITED KINGDOM,

R. & J. DEMPSTER, LTD., MANCHESTER.

PARKINSON'S

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Equilibrium Governors.

A very large number are now at work; and all Engineers who have adopted them speak in unqualified terms of their

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PARKINSON AND W. & B. COWAN, LTD.
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Printed for WALTER KING by King, Sell, & Olding, Ltd.; and published by him at 11, BOLT COURT, FLEET STREET, in the CITY OF LONDON.—Tuesday, April 28, 1903.